THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXI. No. 2077.] LONDON, MARCH 3, 1903. [55TH YEAR. PRICE 6d.

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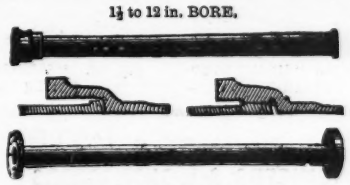

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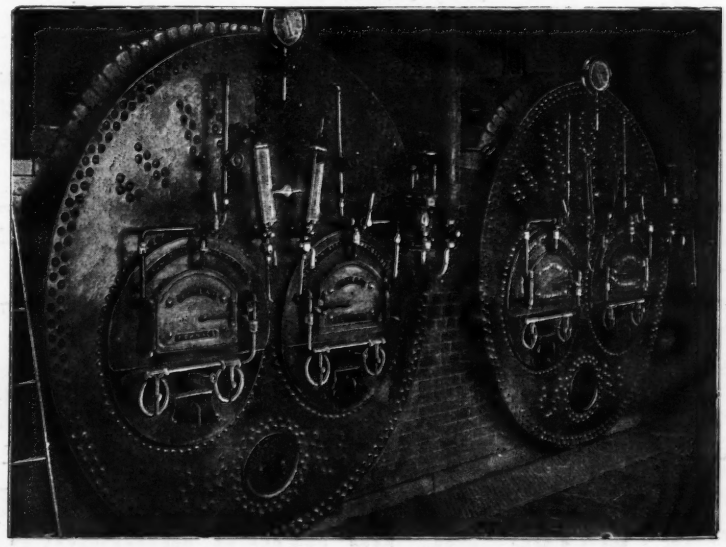

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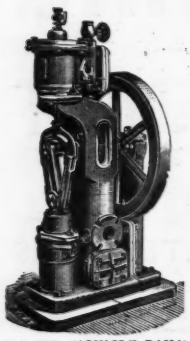

Fig. 705. "SINGLE RAM" STEAM-PUMP.

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

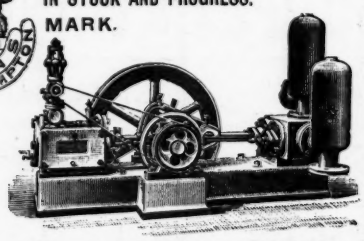

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

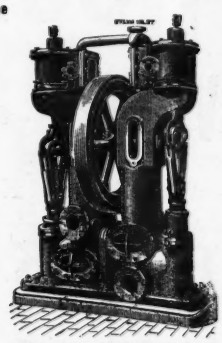

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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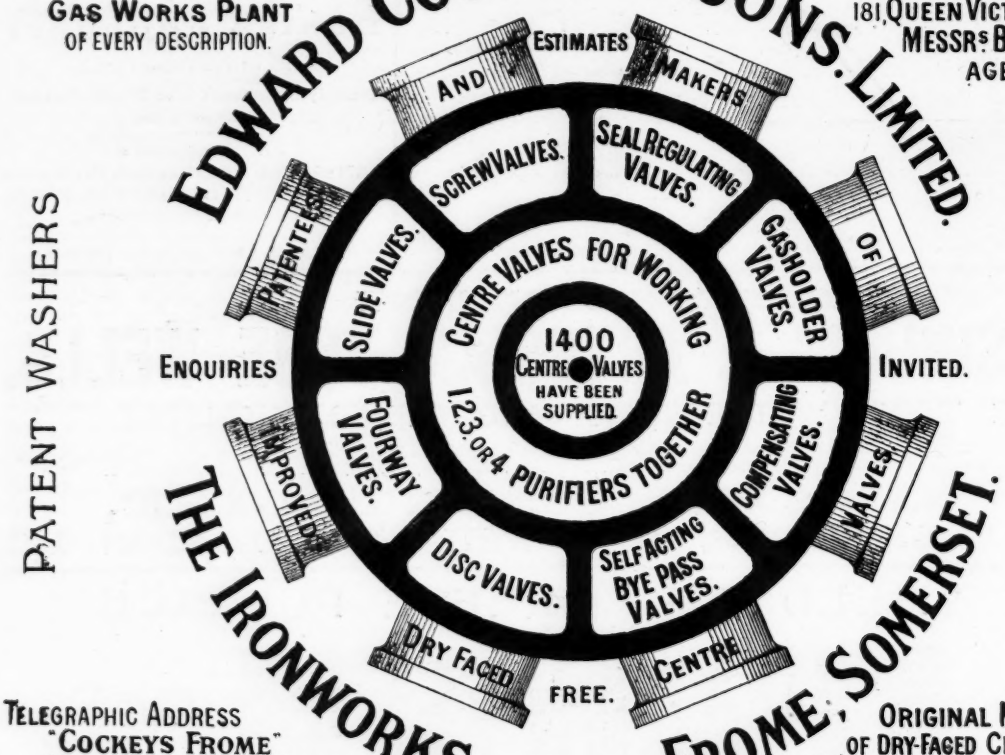

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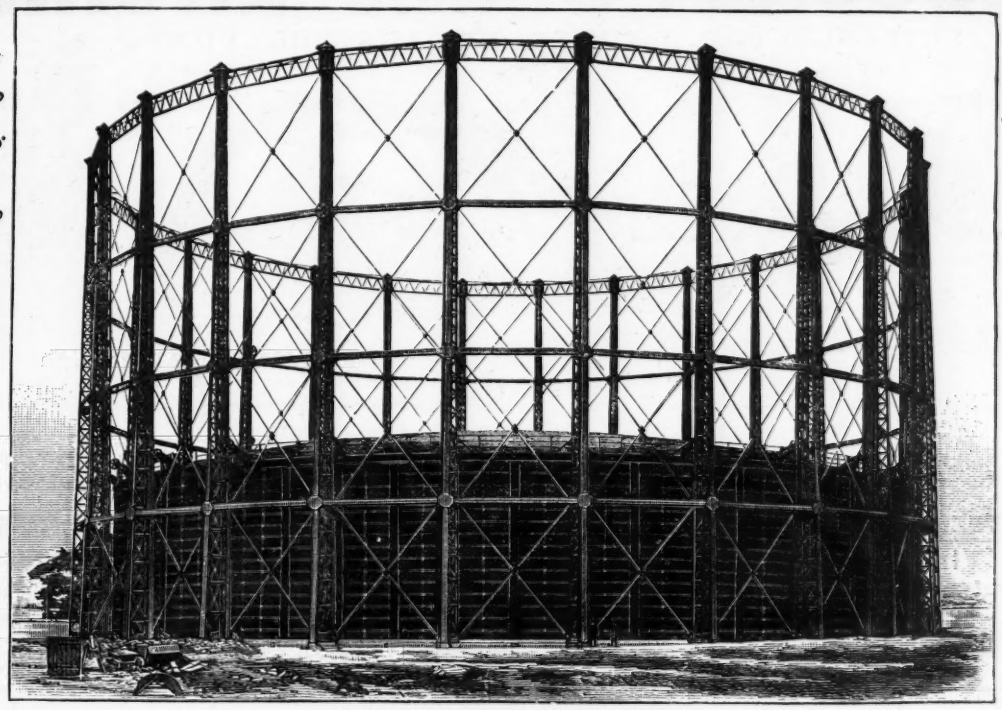

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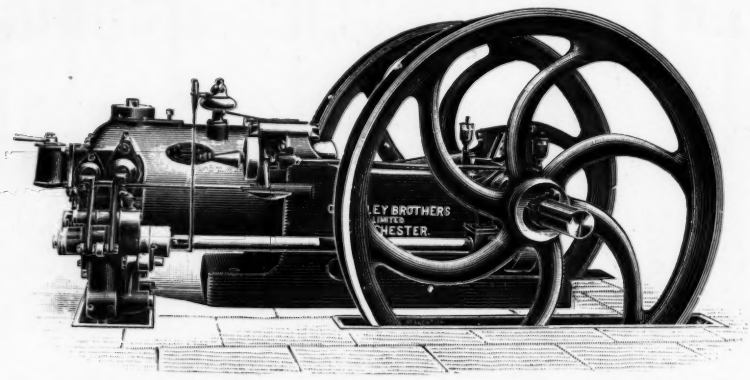

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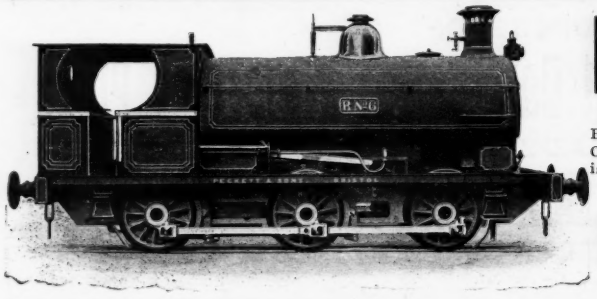

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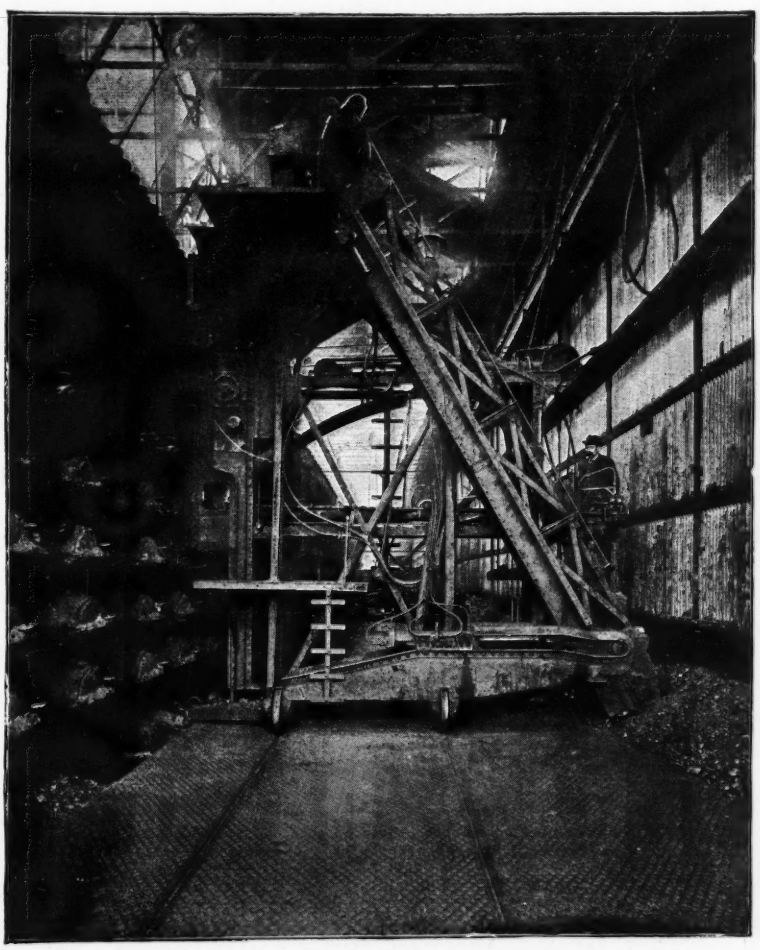

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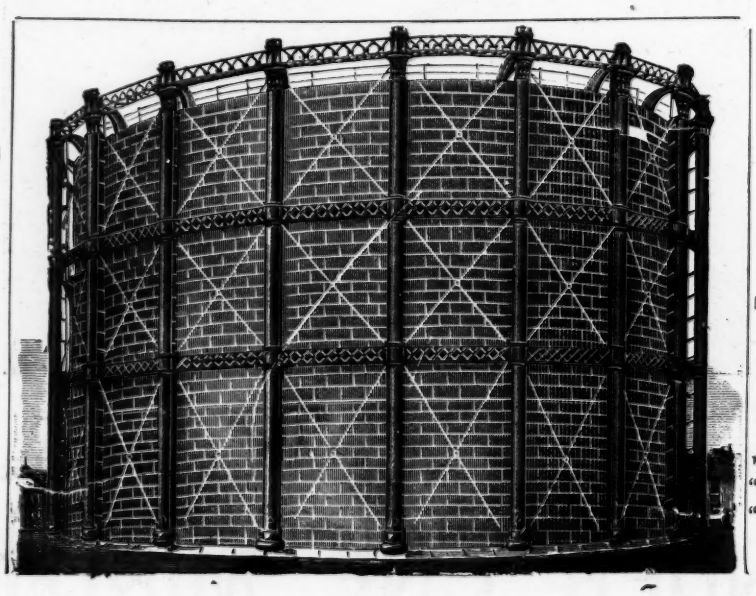

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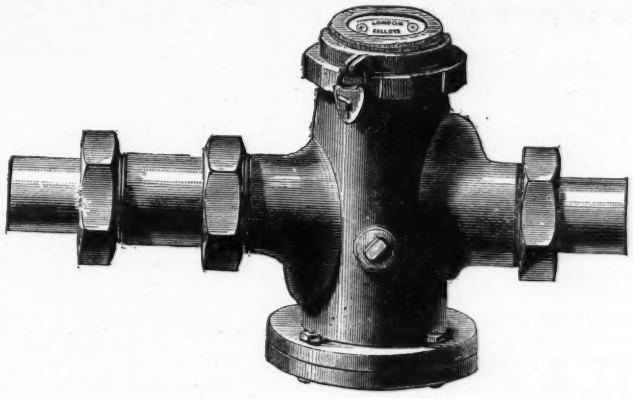

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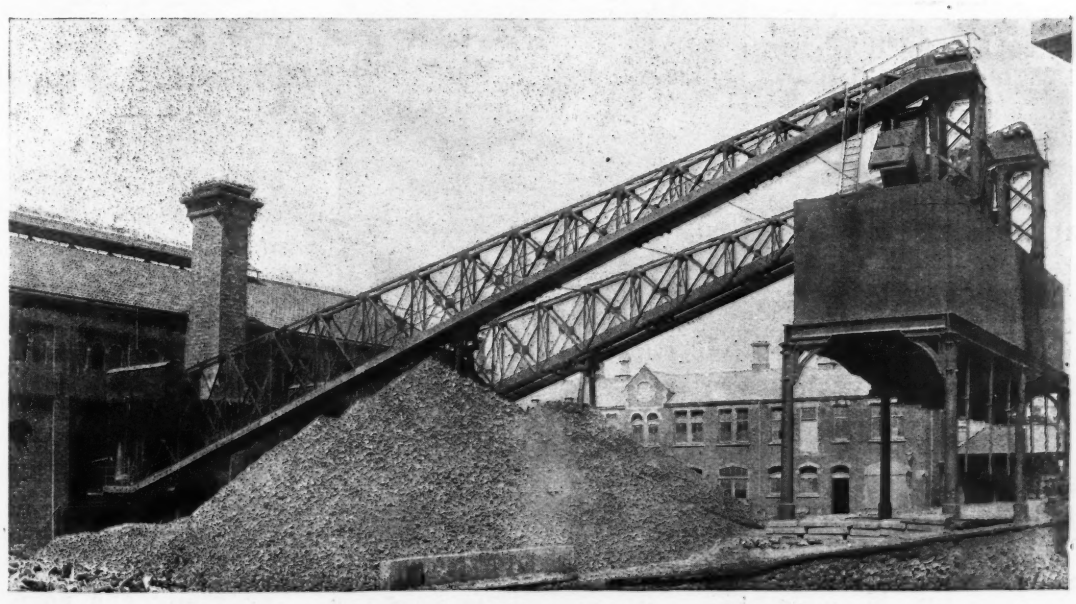

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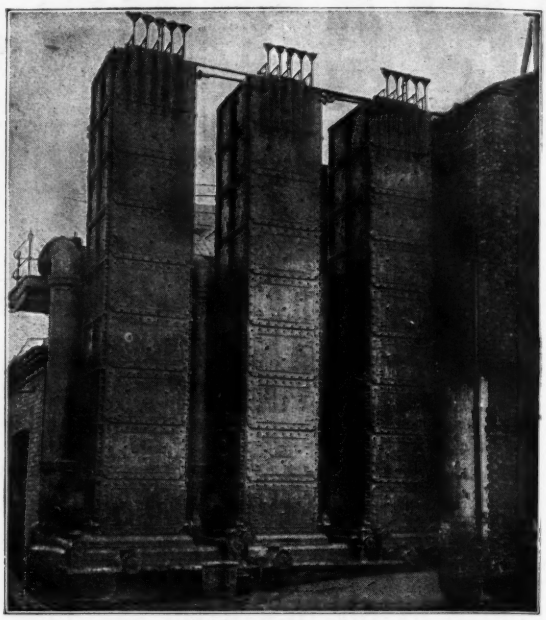

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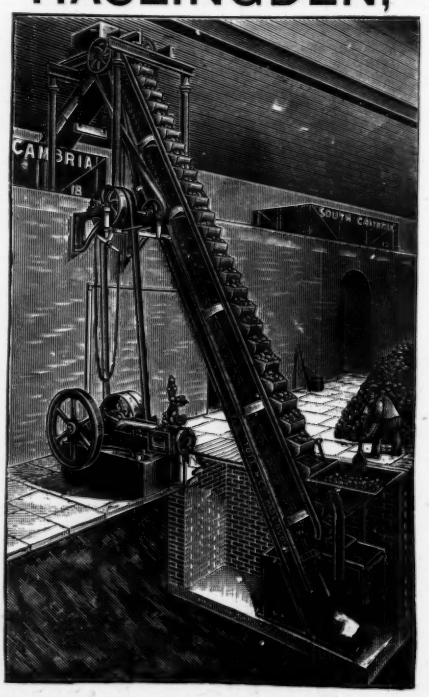

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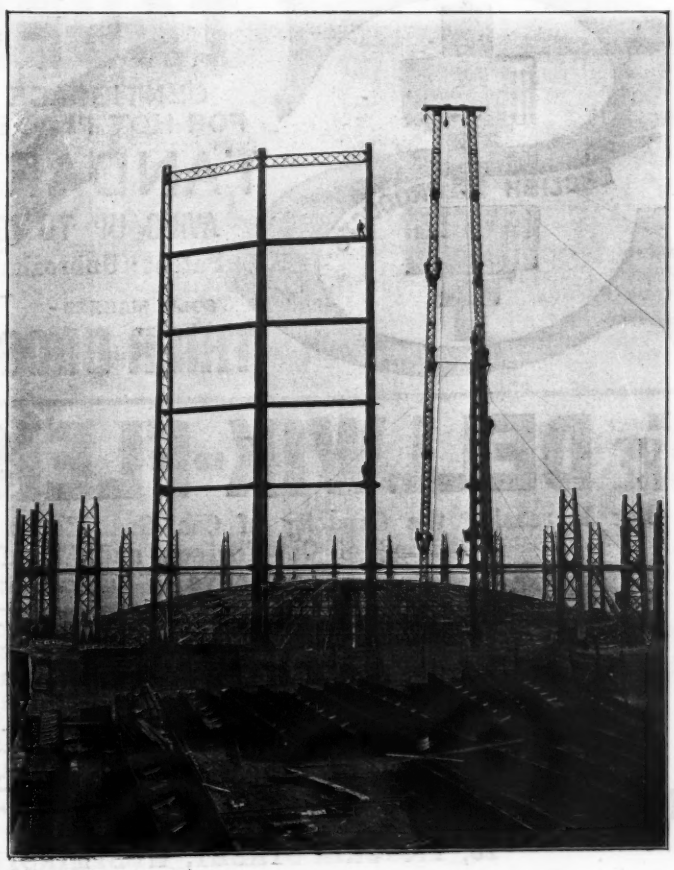

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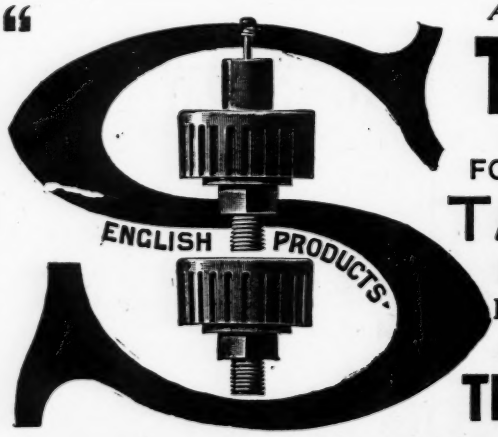

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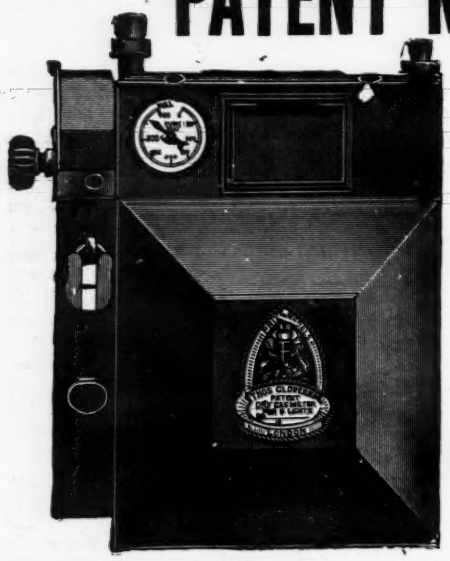

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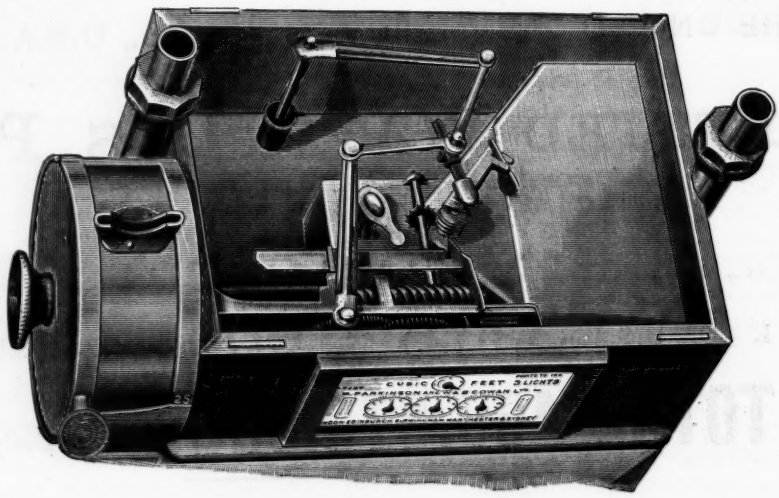

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EDITORIAL NOTES.

The Honorary Membership of the Institution.

ANYONE who may have indulged the expectation that the statutory general meeting of the Institution last Thursday would be the occasion of a "scene" anent the question of the Honorary Membership will have been disappointed or gratified according to the bent of his feelings. There are some, it seems, who would like to see the first meetings of the new Institution turned into something approaching a bear-garden over this matter; but among the members who do not agree with the strict conformity of the Council with the Articles which governed them in the ballot, we are confident there are but few who would not deplore any such factious proceeding, and prefer to gain their end in a more pacific fashion.

But the statutory meeting has passed without any happening of the kind, or, in fact, without even the shadow of an effort to create unpleasantness. The meeting was small (numbering not more than three dozen members), and was to the extreme decorous and friendly before, during, and after the few minutes that were required by the President (Mr. Andrew Dougall) to make his formal report that the incorporation and registration of the Institution had been duly carried out. Neither was there any hint from the President that there was any disagreement abroad with the verdict of the Council over this particular question. All this supports the idea that the discontent is not so widespread as some would have us believe. So far as we have been able to gauge, many of our commercial friends rather regard the hubbub over the question with amusement than otherwise; and, save but a few, they are not taking the matter nearly so seriously as some of their intercessors. The fact, too, that less than half the old members and associates who are engaged in trade made application for honorary membership, is a point in proof of the general indifference among them. This was remarked upon in the course of a conversation with a gas-works contractor only a few days since; and he, at all events, regards the decisive result as the best thing that could have happened, from the point of view that, had more been admitted to honorary membership under Section II. of Article 5, the greater would have been the discontent among those who were rejected, and the greater the struggle to secure a revision of the decision of the Council.

The whole subject was fully discussed in the "JOURNAL" for Jan. 20; and there is no occasion to iterate the views that were expressed. The general position then taken up, and the line of argument followed, were founded on the only possible interpretation of the intention of the Articles, and on the confidence entertained in the umpireship of the Council in view of its peculiarly fit constitution for the task entrusted to it. It shows the good sense, the willingness to allow liberty of view, and the fair feeling that prevails in the trading section of the gas industry, when we are able to state that the attitude of the "JOURNAL" on this (what is merely a political) question has brought reproof from only a single quarter; and in this one instance we feel convinced it was due to an insufficient consideration of the whole of the circumstances and the points previously advanced. It is inconceivable how anyone could have taken the article in question to have any personal application—particularly as it was clearly indicated that, beyond the names of the two successful candidates for honorary membership, there was no knowledge as to who were the men who had applied for admission to that class. "For our own part," it was remarked, "we should want to see the list of men who presented themselves for election, before daring to impeach a "verdict given under such conditions"—the conditions then mentioned.

But this one protest from a private correspondent leads up to an altogether different point. When last writing on this subject we were commenting on a situation created by the definite limitations imposed by the Articles, and not criticizing the Articles themselves. If we had been, in the light of what transpired at the meetings held towards the close of last year (when the Articles were unanimously accepted by the members present), the absence of provision in them for the admission of those old members *with technical qualification* who are connected with the commercial side of the industry would have been a point for regret. We refer particularly to those quondam gas managers who have entered into commercial relations with gas undertakings, and also to certain of the trading and constructing engineers who have, as many gas-works bear witness today, "specially promoted the interests of the gas industry." In the article of January 20, it was shown how the latter and some of the non-applicants could be dealt with under Article 24. Consequently it is a pleasure to learn that the Council have decided to put this Article into operation at the first annual meeting in June, and also to propose that those former members who, once gas managers, have adopted a fresh avocation in connection with the industry shall be returned to (it is believed) their old class of membership. The Council may not, strictly speaking, be legally entitled to do this; but we do not suppose that any one is likely to question their action.

Affairs of the Nottingham Gas Department.

THE long-expected reports on the Nottingham Corporation gas undertaking have been made public; and we give in full the observations of Sir George Livesey on the condition of this property, which he has had under consideration since last October. Two reports of Mr. J. H. Brown, the present Gas Engineer to the Corporation, are also included in this survey of the undertaking. It is unnecessary to bespeak attention to these statements, coming as they do before the public at a juncture when the doings of municipal corporations in all kinds of trade are being so keenly canvassed. There are particular reasons, also, why the affairs of the Nottingham Corporation Gas Department should interest gas engineers; but these need not here be specified. The general question submitted to Sir George Livesey really raised the problem of the success of municipal gas supply under conditions which would not on their face be classified as otherwise than favourable, and generally satisfactory. What, it might be asked, could be the matter with the Nottingham gas undertaking? Yet, somehow, the responsible custodians of the property wanted to satisfy themselves and their constituents that all was right. Besides, there was the not very distant example of the Sheffield United Gas Company, which some thought was better administered than the Nottingham Corporation Gas Department. Sir George Livesey was asked to say how this was, in point of fact. He accepted the commission, though we almost wonder that he ever consented to undertake the task. But possibly its very thanklessness and difficulty attracted him. Moreover, if he were made to understand that a gas undertaking, however small, was in need of the help of his advice, we believe he would find it difficult to resist the appeal.

The first point made by Sir George Livesey in comparing Sheffield with any other gas undertaking—not merely with Nottingham—is the completeness of the equipment of the former Company on the commercial as well as on the industrial side. This is certainly an advantage enjoyed by the Sheffield Company over every municipal undertaking, and also over most gas companies in the kingdom. Almost with this exception, either the engineer or the secretary of a big concern is expected to double the part with that of the general manager, or business man, with the result that the commercial life of the undertaking is starved. Of course, there are exceptions; but the rule holds good in a general way. Sir George Livesey quits this point to dwell upon the comparative sluggishness of growth at Nottingham as contrasted with the rapid expansion of either Leicester or Sheffield. He next fastens upon the real *crux* of the matter—expenditure upon capital account—and then lays down the law of sound finance very uncompromisingly. Here he

is "getting warm," as children say in their adaptation of the searching game; for, like all gas proprietors greedy after profits, Nottingham have not been disposed to burden their revenue too heavily. But he positively "burns" over the immediately ensuing question of the comparative advantages of the various forms of modern carbonizing plant installed at the different works of the Corporation. It is not often that so searching an examination into the manner of working of these appliances and arrangements is publicly made. It is one thing to read descriptions of carbonizing plant in professional papers, and quite another matter to follow an independent investigator through the following year's carbonizing books. What is said about the inclined and horizontal systems of retort-setting will command respect and travel far.

It comes with rather a sharp surprise that Sir George Livesey should have so much to recommend to the Nottingham people which is not by any means novel. The most serious of his criticisms refers to the prices paid for coal at Nottingham and the returns received, compared with Sheffield. Naturally, he pounces upon the high quality of gas maintained—18¾ candles—as a piece of useless extravagance. The statutory illuminating power in the case of Nottingham gas is equal to 14 candles by the "London" argand standard; and the cost of enrichment could in this case be suppressed by a simple order. Other economies would be secured by the same reform, especially as regards the purchases of coal, which need placing upon a fresh basis. All Sir George's words on this subject are wise, and very much to the point. In view of Mr. Brown's recent appointment to the engineership of the undertaking, his reports form interesting reading, especially the first, which antedates that of Sir George Livesey, and on several important points anticipates his advice, with the addition of some special observations on the chemical works and plant. He warmly advocates the reduction of the illuminating power of the gas, and is of one mind with Sir George upon the subject of the coal purchases. All this is of good augury for the future of the Nottingham gas undertaking in Mr. Brown's hands as Engineer. He will require competent assistance; but it seems debateable whether this had better be on the lines indicated by Sir George Livesey, or with respect to the working up of the business by modern methods.

The Lesson of Nottingham.

THERE is one lesson to be learnt from the Nottingham reports which has far more than a local or temporary interest for the gas manager. It lies broad upon the surface of these authoritative statements, and it can also be distinguished between the lines. It is merely the truism that the prosperity of any gas undertaking is based upon the excellence of the carbonizing; and that the ancient commonplaces of the philosophy of gas management, as laid down by Mr. Thomas Newbigging in that famous "Handbook" of his, are once more justified in this regard. Both Sir George Livesey and Mr. Brown observed that the heats at Nottingham were not good; and when that is the case, there is little more to be said until the shortcoming is repaired. It seems so obvious and so easy a thing to look after; and yet the longer one lives the clearer does one perceive the importance of making quite sure of the matters that are so commonly taken for granted. Human experience is full of this lesson, which it seems as though none could possibly miss; yet it so often is missed! The art and craft of gas management is not, of course, bounded by the walls of the retort-house; but it begins there. Underneath all the disputations concerning the comparative merits of this or that system or device of carbonizing, there lies the necessary assumption that the heats are right. Without this basis, nothing is stable; no professional memoir worth the paper on which it is printed. It would be well if the assumption could be more safely made than, there is reason to suspect, is always justifiable. Visits of inspection to gas-works are too often rendered of no effect by the existence of a too-evident "note" of preparedness, or sometimes by patent signs of bad working. Not seldom in the case of works thrown open for inspection for the sake of some speciality of retort-house design, construction, or equipment, the carbonization is either spectacular or is inadequate to the earning of dividends. The visitors are expected to look at one thing, and are not asked their private opinion of other matters which they cannot help seeing. It used to be taken for granted that a really expert gas manager must of all things be a good carbonizer; but there have always been holders of this position who failed to understand this part of the gas business. This was the justification for the existence of specialists in gas-works improvement, whose names will occur to "JOURNAL" readers, and who did well with so-called "systems," whereas better carbonizing was really at the bottom of their success.

Here is the point—whether, in any gas-works, the responsible manager would like to have his retort-houses visited, and his carbonizing books overhauled, at any moment, without notice, by the sharpest critic of carbonizing he knows. The retort-house is the gas manager's cash-box. Just as the bank cashier must be prepared to vacate his charge at the coming of the inspector, so should the carbonizer be able to submit to the judgment of anyone who knows good retort working when he sees it. Unfortunately, straightforwardness in this kind of work is hindered by all sorts of prejudicial influences. Sometimes the manager has a fad which he wishes to defend; and in such cases the foremen have an embarrassing way of anticipating their master's desires. There is, or should be, a reason for everything in the retort-house—for every dimension, weight, and rule of working. Sir George Livesey told the Nottingham people that it is not good business to push even improvement too far. An illustration of this truth occurs in connection with carbonizing. Here the last points of perfection may cost more than they are worth. A master of his business will know where to draw the line of convenient working on the safe side of absolute perfection. Many good arrangements prove unsatisfactory because it does not pay to work them to their utmost; as the engine which is very economical at its full load may not be the most suitable for driving at a prudent margin below this limit. The gas manager should at least know all this, and if he prefers to stop trying after perfection at any point, he should be able to give adequate reasons.

At last, however, one comes back to the good old rule that, by whatsoever system coal is carbonized for gas making, the heats of the retorts must be kept up. To this conclusion all good gas managers must subscribe; and whatever the character of their early personal training—whether they started as chemists, or mechanical engineers, or electricians, or clerks—they must end by having the consciousness of this rule burnt into their minds. It is the peculiar advantage of the student of gas manufacture who is brought up in the works, as compared with one who is occupied elsewhere, that he is more likely to imbibe with the breath of life this cardinal verity. He may not be so well able to "floor" a paper" at an examination, or, of course, he may be quite as good as another at paper work; for there is no antithesis in this case. If he knows the importance of good retort heats, and how to secure them, a gas manager has the root of the matter in him; and the more he knows besides, the better for him. Without this grounding, he may know everything else, and yet be incapable of earning a good profit for his employers. It would be quite a mistake to think that a good carbonizer must necessarily be one who has charged retorts himself as a stoker. Mastery of fire is usually beyond the powers of an uneducated man, or of any man who has not given his mind to it. Frederick Siemens is the type of the master of all those who work with fire; and it is a craft which demands a long apprenticeship to learn it. And what nobler art can a man desire to excel in than full mastery over that manifestation of natural energy which men have worshipped as divine, and long afterwards regarded with scarcely less awe as an element of the constitution of the Universe?

Fresh Alarms in the South Wales Coalfields.

MR. PICKARD and his colleagues of the Miners' Federation of Great Britain have during the past week caused a considerable flutter in the South Wales coalfields—and, consequently, in the coal markets throughout the country—by declining to give the South Wales Federation permission to enter into the three years' wages agreement with the coal-owners which has been practically arrived at after the long and desultory negotiations that have been keeping the coal market unsettled and uneasy for some months past. The possibility of this difficulty arising has been from the first pointed out in these columns, as the natural insistence of the coalowners that, if they made to the men the great concessions to which they provisionally agreed, they should in

return obtain the assurance that the settlement would remain undisturbed for at least three years, was, and is, in direct antagonism to the policy laid down by the "superior" Federation at the Stockport Conference last October. The policy of Mr. Pickard as then declared is to make a combined attack on the coalowners of England, Scotland, and Wales at the end of this year, with a view to raising the "minimum wages standard" throughout the Federation area. If this policy did not suit the South Wales owners or the South Wales Federation, that was a matter of little interest to Mr. Pickard, who, in effect, said—in the expressive, if inelegant, language of the common people—"if they "don't like it, they can lump it." Now Mr. Pickard, to his great surprise and indignation, finds that both owners and men incline to a third course—that of "bye-passing" his policy, and making their own arrangements.

Last Friday week, the Federation of Great Britain refused to the projected three years' agreement for South Wales the sanction required by the rules under which the Welsh Federation was affiliated to the larger Society, and adjourned their conference until "Mabon" and his fellow leaders could again approach the South Wales owners and endeavour to get the three years' stipulation withdrawn. This they did, and received the answer they doubtless expected—namely, that the owners had nothing to do with Mr. Pickard's organization; that they had accepted the assurance of the men's representatives with whom they had been negotiating, that they (the representatives) were fully empowered to settle the new agreement; that they would not entertain for one moment the proposal of a one year's settlement; and that they should serve notices at once on all their men to leave work on March 31, so as to put an end to any such nonsense as this intervention of Messrs. Pickard and Co. Subsequently, however, the owners agreed not to serve the notices until after the men's leaders have laid before the superior Federation the answer of the coalowners, and obtained the final decision of that body; and, reading between the lines, it appears pretty well certain that either the Welsh leaders have reason to believe that they will be able to obtain the reluctant sanction of the Federation (tacit, at least, if not expressed) to the three years' agreement, or that they are determined to do without it if it is refused, even if the result be to sever the Welsh Federation from the organization now dominated by Mr. Pickard. "Mabon" and his co-negotiators know too well the value of the terms that are within their grasp to abandon them lightly for the very doubtful chance of obtaining better by fighting, either now or in ten months' time; and we think there is little reason to doubt that Mr. Pickard will find that his plans, flaunted so openly in the face of the coalowners of Britain, for taking them at a strategical disadvantage in December next, have served chiefly the purpose of pointing the moral: "In vain is the "net set in the sight of any bird." In the early stages of the negotiations in Wales, there were serious grounds for fearing an unfavourable upshot; but we think these fears need no longer be entertained.

The Beginning of the Parliamentary Session.

Parliament has resumed its labours; and we, who think of it as something other than the great debating society which it appears like to the newspaper reader, have to look out for the course of legislative business. Already the sticklers for the maintenance of parliamentary traditions are shaking their heads over last Friday's "count out," which, they protest, confirms their gloomy prognostications of last year, when the private members' day was changed from Wednesday to Friday. In view of the growing fashion of "week-ending," and the fascinations of Saturday golf, it was freely prophesied that great difficulty would be experienced in keeping a House for private members' purposes on Fridays; and so it seems. Yet, as most things have two sides, the small and select attendances on Fridays may prove an advantage rather than an obstacle to the progress of really sound private measures. The truth of the matter is that the character of private members' Bills has suffered of late years from the prevalence of the "hardy annual" in their midst. These are the measures which will never become law, yet crop up again with monotonous regularity year after year to take their chance of the ballot for precedence. Last Friday it happened that a couple of respectable Bills went forward a stage by common consent; but when the inevitable Sir Albert Rollit took the floor with one of his numerous legislative bantlings, the House all of a sudden remembered that it had not a quorum, and the proceedings terminated.

As regards the Private Bills relating to the gas industry, Mr. Nicol has given notice of his intention to oppose the second reading of the Gaslight and Coke Company's Acts Amendment Bill, promoted by the London County Council, which was down for yesterday; and he is likewise opposing the London County Council (General Powers) Bill. Two other objectors—Sir Frederick Banbury and Colonel Legge—have put down an Instruction for the Committee to omit clauses 63 and 64 of this Bill. These clauses constitute the much complained-of part of the Bill which is to give Metropolitan Boroughs power to fit up houses with electric light wires and appliances. There is not much chance, one would think, of this preposterous proposal getting through Parliament; and the London County Council ought to receive a rap over the knuckles for entertaining it. The mere fact of the Council having done so exhibits the unreliability of this body, as at present constituted, for the purpose, which it ought to fulfil, of safeguarding the ratepayers' interests. It sounds almost like a joke, this coupling of the name of the London County Council with the interest of ratepayers of the Metropolis, which is a sign of the extent of the alteration of this body from the intentions of its framers.

Problems of Street Lighting.

The figures of the interesting and valuable report of Mr. J. W. Bradley, the City Engineer of Westminster, on the street lighting of the City, which is arousing much interest just now in several quarters, were discussed last week. All we desire to do here is to express regret that a matter which has often been brought forward in these columns, and never mentioned, to the best of our knowledge, by others—the effect of the character of street frontages on the brightness of the streets as a whole—has almost escaped Mr. Bradley's criticism. It is greatly to be wished that some popularly esteemed arbiter of taste would take up this aspect of street architecture, and lead public opinion into a healthy state respecting it. In the circumstances, we venture to suggest to Mr. Bradley and the Westminster Corporation that until some better understanding is arrived at as to the points of good street lighting, including the frontage effect, all expressions of personal opinion as to what is or is not good lighting in any particular street must be largely empirical. Unless there are some sound data to go upon, the best-intentioned Corporation Engineer can but offer his word as to what is or what is not a good appearance of a street by day or by night. In the present example, Mr. Bradley allows it to be seen, as it were incidentally, that one of the points by which he sets store is the comparative frequency in a line of street of the lamp-columns, which he regards as "impediments to traffic." They may be so, in a particular sense and at certain times; but how about fogs? Is not a reasonable expectation of being able to see one public light from the next one of the row something to be aimed at? There is in the dark intervals a good deal worse impediment to traffic than lamp-posts make, where these are too widely separated. Besides, apart from the case of fogs, spottiness of street lighting effect due to the placing of too powerful lights too far away from each other is not pleasing, nor useful in any way.

It is satisfactory to note that Mr. Bradley is not at all prejudiced in favour of one means of lighting over another; he considers that both gas and oil lamps of high power would do much better on posts equal to the present average electric lamp in height. As a matter of fact, this rule is already generally followed; but it should not be forgotten that the choice of the amount of light for every lamp is governed by the circumstances—chiefly the width of the street. He should make an evening pilgrimage through the darksome ravines of terra cotta that lead from the Strand to the Victoria Embankment, and then take a survey of the Regent Quadrant, which is a plain old-fashioned white painted frontage. The comparison would convince him that the degree of street surface illumination is not to be calculated from the estimated illuminating power of the lights, to say nothing of the general effect. What the architects of the new London street frontages can have been thinking about, to give so many of them a face that would look dark in Italy or Spain, is a mystery. It can only be imagined that they never thought either about the London climate or the lack of

light. Who would not say that the architect of the Regent Quadrant was not clearer sighted than his successors? At the present time, London is being largely rebuilt. Pictures of "disappearing London" are in the papers every week; and there are those who deeply regret the changes that are going on. We shall have a light and airy structure, with a pretty dome, on the site of frowning old Newgate Prison. The Westinghouse Building is what the new Strand will be like—*i.e.*, all Portland stone and plate glass, with machine-made embellishments along the sky-line. Of course, it will be a great improvement; but it will be just as well for the Corporation of Westminster to carefully label the streets, or we should never know them from any others. New London will be simply commonplace; and just like new Paris or new Berlin. It might at least be as bright; and this will be for Mr. Bradley to struggle for with our architects.

Texas Oil.

A SHORT time ago we had occasion to discuss the question of the probable duration of Texas fuel and gas oil supply, upon unfavourable reports emanating from the American correspondent of the "Pall Mall Gazette." At the same time, we expressed surprise at the silence of the "Petroleum "Review" on those representations, so detrimental to the Texas oil interest. The reproach touched our oleaginous contemporary, which accordingly volunteered the information, upon the scarcely disinterested authority of Colonel J. M. Guffey, that Spindle Top is producing 30,000 barrels a day, and that the average yield of the wells in this district is between 300 and 500 barrels a day, "which is a very fine "output indeed, as petroleum wells go." One would think so, and be pleased to hear that the newly-found wealth of Texas had not so suddenly taken unto itself wings and departed. But now comes further evidence on the same side. The "Pall Mall Gazette" gives publicity to a letter signed E. W. Humphrey, who asserts that the original report was erroneous and misleading, and that there is every prospect of the yield of Spindle Top continuing for years. There appears to have been, by this writer's account, a good deal of "operating" on the field, with the object of "eliminating "the speculator," whoever he may be. The gentry so classified are described as unprincipled persons who created paper values from nothing; their method being to acquire oil lands, and cut them up into tiny patches just big enough to accommodate a well which it was hoped would prove a "gusher." If it did, very well and very good, because the property could be traded off at an enormous profit. Other wells never gushed, and these were readily abandoned for any excuse, such as the appearance of salt water therein. Meanwhile, a vastly superior order of beings, described as "legitimate" oil producers, looked on, and bided their time. They cared not at all for gushers; but they believed in pumping. When the gushing was over, these representatives of the divine right, or legitimists, "absorbed" their weaker brethren, and in the course of a few months will inherit all the oil land of Texas. Then we shall see what we shall see. There is still a flavour of speculation about the business, inasmuch as one of the larger Companies showed a net profit of £10,000 for the month of January for an expenditure of less than £500; "and it is believed by "practised oil experts (not theorists) that this rate of produc-"tion will last for years." Production of profit, or of oil? The proof thus tendered is altogether too good. A clear profit of £500 for a month upon an expenditure of £10,000 would have looked sufficiently rosy; but as the figures stand they overshoot the mark. One would like to know for certain how the Standard Oil Company are getting on with their big refinery at Beaumont, and what they still hope to do with it.

The Effects of a Careful Watch on the Capital Account.

Two of the luminaries in the firmament of the gas industry are found, in this week's news, enlarging on the importance of keeping a watchful eye on the capital accounts of gas undertakings. Sir George Livesey makes a strong point of it in his report on the Nottingham gas undertaking; and Mr. Corbet Woodall made the most noteworthy speech of the week at gas companies' meetings in referring to this subject last Friday at Croydon. The object of his remarks was to show how well the shareholders and the consumers had been served, and how much they had benefited, through the care exercised by the Directors of the Company—and we should like to add by the Engineer also—in the expenditure of capital. While the illustration is local, its instructiveness has a wider range of usefulness. In the case of Croydon, not a penny is placed to capital account for works other than absolute additions to the value of the plant; and the result is presented in the figures Mr. Woodall gave covering the past twenty years. They will all be found elsewhere; but these may be quoted as examples: In the period mentioned, there has been an increase of 222 per cent. in the gas business; but the capital has only increased by 125 per cent. The effect, so far as the consumers are concerned, is a saving of nearly 50 per cent. in the amount required for dividend—that is to say, in 1882, 18d. per 1000 cubic feet was needed for this purpose, while now only 9½d. is required. The shareholders, on the other hand, through the cheapening of their product, have vastly expanded their business, and thus increased their security. Mr. Woodall also pointed out another fact which is sometimes lost sight of. It is this—that the items upon which a gas company are called upon to spend money have in the last few years materially increased, and that the cost of equipping gas-works in approved up-to-date fashion is greater now than formerly. In view of this, when he tells the uninitiated of Croydon that, while the capital is now £530 per million cubic feet, the increased business of the past twenty years has been obtained at an expenditure of £425 per million, they must regard his speech as disclosing a somewhat anomalous state of things. Of course, the whole secret of this is to be found in the amounts charged in various ways against revenue, and in the economies and better working results achieved by the aid of the more costly plant now employed.

The Bristol Gas Company's Jubilee.

The special feature of the proceedings at the half-yearly meeting of the Bristol Gas Company last Thursday, as will be gathered from the report which appears in another column, was the portion of the speech of the Chairman—Mr. J. W. S. Dix—in which he traced the progress of the Company during the past fifty years, for this is the Jubilee of the undertaking as at present constituted. As a supplier of light in the city, however, its operations have extended over nearly a century; for as far back as 1819—not very long after the introduction of gas into the Metropolis—the Bristol Gaslight Company was incorporated. It would have been interesting to know what the city was like in those days, and how many of its population of about 70,000 within the municipal boundaries the Company served. But Mr. Dix was silent upon these points; and possibly, in regard to the latter, no records remain. However, the concern did not remain long the sole purveyor of light; for in 1823 the Bristol and Clifton Oil Gas Company was incorporated. The projectors of this undertaking were wise in their generation. They recognized in the "beautiful village"—which, though mentioned in the Domesday Book, had little history till it acquired this title in 1760—a future field of operations. This "village" is now a large and handsome suburb of the city, and forms part of it for municipal and parliamentary purposes. Oil as the raw material for gas making was evidently found in practice to be unsatisfactory; for thirteen years later—in 1836—power was obtained to use coal; and in 1847 the name was changed to the Bristol and Clifton Gaslight Company. The lighting business appears to have been divided between the two Companies till the year 1853, when the undertakings were amalgamated under the style of the Bristol United Gaslight Company; and in 1891 the word "United" was omitted from the title. What progress has been made since that amalgamation! From 190 millions in 1852, the make of gas has risen to 2285 millions; and the price has been lowered from 4s. 6d. to 2s. 3d.—7d. having been taken off in the nine years during which the Company had to meet the competition of the Corporation's electric light undertaking. The latest reduction—in commemoration of the Jubilee—specially benefits the outside consumers, who have been placed on the footing of those in the city. The "forward movement" in connection with gas supply which was initiated in the early eighties was recognized by the Directors as the right policy; and accordingly they commenced in 1888 the fixing of cookers. By 1892 they had out on hire 2196 of these appliances, the value of which has been so well appreciated that there were in operation at the close of last year no less than 19,560 of them. Similarly with the prepayment system.

In the decade just closed, the number of "penny-in-the-slot" meters in use rose from 20 to 6955. As the Company's prosperity has increased, so, it may be pointed out, has their contribution to the rates of the city. In the forty years from 1862 to 1902, the payments on this account rose from £1294 to £8962; the latter figure being equal to 1¼d. in the pound of the entire rate. The figures cited by Mr. Dix furnished a remarkable record of progress—one, indeed, which no less an authority than Mr. Corbet Woodall considers can be hardly equalled by any other company. May it continue for many years to reward the enterprise and energy of those who superintend the working of the undertaking.

English and American Gas Supply.

Our contemporary "Progressive Age" has been commenting upon the recently issued returns relating to the gas undertakings of the United Kingdom, the principal totals from which were given in the "JOURNAL" for the 20th of January (p. 157), and making some interesting comparisons between the gas supply here and on the other side of the Atlantic. In order to do this, it has been necessary to reduce our currency to American equivalents; and the result is that our 705 reporting works—a number which is considerably less than those existing in the United States—are found to employ $529,850,905 of capital out of the $610,668,467 authorized. According to the United States census report for 1900, the stocks and bonds issued by 877 gas companies amounted to $567,000,506. Of the total bulk of gas sold here, 16·6 per cent. was water gas, against probably 75 per cent. in America—a very wide difference. Dividing the total quantity sold among the whole of the consumers, each one took 36,740 cubic feet in the year, which is rather better than our cousins can claim. This is attributed to the low price at which gas is sold on this side. According to the census returns just referred to, the capital issued per 1000 cubic feet of gas sold in the United States in 1900 was $8·45. Our make has increased about 116 per cent. during the past twenty years, and 40 per cent. since 1892; but the sales in the States during the census decade went up 83·7 per cent. Our contemporary is naturally proud of this result, for he says that, when actual statistics are in evidence, the magnitude of the gas industry in America "takes no second place with that of England." He therefore asks why it is that gas men on his side "refer to England with such reverence as the final court of resort in deciding policies gaseous." Why, indeed! No doubt the gas business in America occupies a prominent place; but, as is pointed out, this very prominence carries with it increased responsibility. In the early days of an industry, as in those of a human being, certain inadequacies are excusable; but in the course of time, and with ripened experience, these should be gradually remedied. Our contemporary considers that the national credit is at stake, and he is gratified to find that American gas engineers recognize this, and are making efforts to show what really good work they can do. The gas business is growing there as here; and the more cheaply the commodity can be sold, the greater will that growth be. There will necessarily be powerful competitors; but "the most for the dollar" will be an effective weapon with which to meet their attacks.

The Acetylene Industry.

Some useful work has been performed during the first twelve months of its existence by the Association devoted to the acetylene industry, as was shown by the Chairman (Mr. F. G. Worth) in his address to the members at the second annual meeting last week, a report of which appears in another column. Like all new industries, that relating to acetylene has had (and still has) considerable difficulties to overcome; and therefore the banding together with a common object of those engaged in it must be of incalculable benefit both to manufacturers and users. That this fact is appreciated by many of those whom it concerns is evident, seeing that the Association already boasts of 91 ordinary members, to say nothing of an extensive array of honorary members, which includes the names of some of the best-known engineers and chemists. There is good reason for hoping that these numbers will in due course be largely increased; for, as the Chairman remarked, the present membership, though satisfactory for so young an Association, does not nearly correspond with the interests represented. Even as it is, however, the Council have been able to secure some substantial advantages for the industry; but their hands will be strengthened by every addition that may be made to the roll. One of the most important results of the labours of the Council is the regulations for the safe working of acetylene generators agreed to between the Home Office and the Association. Some such rules were urgently needed; and though it is generally agreed that those decided upon incline to overcaution, this is an error in the right direction, and must assist to restore confidence to anyone who may have had his faith in acetylene plants shaken by the reports of the serious accidents that have from time to time occurred with them. Curiously enough, these well-meant regulations have led the Association into something of a quandary. One of the principal points in them (which was insisted upon by the Home Office, and, though contrary to their judgment, agreed to by the Association) is that the pressure in generators should, unless special cause could be shown to the contrary, not exceed 20 inches of water. One of the firms represented in the Association have declined to limit their apparatus to this pressure, or to allow it to be examined so as to see whether it is absolutely free from danger when worked at the higher pressure. What are the Association to do? Though no doubt whatever is entertained that the apparatus in question is perfectly safe, the Council, having issued the regulations, must stand by them or stultify themselves. It is clear that the firm must conform to the regulations, submit their plant for test, or withdraw their representative from the Association. There can be no two opinions as to which would be the best course for them to adopt; and everything possible has been done to bring them round to a more reasonable frame of mind. The Council have, besides their agreement with the Home Office, approached the railway companies with some amount of success regarding the onerous conditions hitherto imposed with reference to the carriage of carbide of calcium; and much greater concessions in the same direction are looked forward to in the future. Altogether, the Association are to be congratulated on the vitality displayed at this early stage of their existence and the promise given of still greater things to come.

The Dublin Oil Discovery.

With reference to the notice of a reported discovery of oil in the basement of a dwelling-house in Dublin which appeared in our pages last week, we have been favoured by the Editor of "Petroleum" with a copy of a report made by Dr. Boverton Redwood on two samples of water and some clay taken from the premises in question. The first sample of water, which was labelled "From trap," was found to have a very slight odour of petroleum when the cork was first withdrawn; and both samples (the second of which was described as "From stream") had to a very small extent what might be termed a greasy character. Analytical examination, however, failed to detect the presence of any hydrocarbons in either case. Though clay is well known to exert an absorptive action on mineral oils, that submitted for test gave no indication of the presence of petroleum. These results certainly do not seem very encouraging; but Dr. Redwood points out that it must not be assumed from them that petroleum was not present on the surface of the water in the flowing stream when the discovery was reported. The particulars which have reached him are of such a nature as to preclude the suggestion that the oil existed only in imagination; but, without further knowledge, it is impossible for him to say what importance may attach to the occurrence. Meanwhile, many prominent persons in Dublin are convinced of the existence of a reliable supply of oil, though they are not inclined to think that it will be found where the first indications were discovered in a running brook. Evidence is said to be in existence that a century ago oil was distilled from bog in the neighbourhood of the reported flow; and thus the old question has been opened as to whether there is petroleum in peat or in lakes beneath peat bogs. We are even assured that it is not unlikely the discussion may lead to something being done in the way of developing a petroleum-peat briquette making industry in the country. The present state of the matter is, however, it seems to us, one calling more for hope than for confidence. Fortune is always fickle, but never more so than—nay, never so much as—in the search for the treasures which are contained within the earth.

PERSONAL.

A few days ago, the position of Manager and Secretary of the Kenilworth Gas Company became vacant by the death, at the advanced age of 86, of Mr. WILLIAM SUTTON. Mr. H. R. SKUTT has been selected to succeed him.

The assistant-managership of the Musselburgh Gas-Works, rendered vacant by the appointment of Mr. J. Ireland to Tranent, as announced last week, has been secured by Mr. JAMES D. KEILLOR, who for the past four years has been under his father, Mr. G. Keillor, at the Nairn Gas-Works.

In the "JOURNAL" for the 17th ult. we announced the appointment of Mr. J. Taylor, of Limavady, as Manager of the Dungannon Gas-Works, in succession to the late Mr. R. Ross. The vacancy at Limavady has been filled by the selection of Mr. DAVID M'INTYRE, Assistant to Mr. Langlands, at Coleraine.

A pleasing ceremony took place at the recent annual reunion of the employees in the gas-works of the Corporation of Kilmarnock, in the presentation to Mr. W. FAIRWEATHER, the Manager, of a gold watch, and to Mrs. FAIRWEATHER of a gold brooch and silver cake-basket. The gifts were from the employees, and were offered, as the inscription on the articles bore, "in appreciation of kindnesses received." Bailie Robertson presided at the gathering (which was held in the Art Galleries), and gave some interesting statistics in regard to the gas undertaking. Mr. Fairweather, in returning thanks, said he had now been seventeen years at Kilmarnock, and this was the third presentation which had been made to him by the employees.

We are sorry to learn that Mr. H. H. JONES has been compelled to relinquish, on account of ill-health, the position of Engineer of the Wandsworth and Putney Gas Company, of which his father, Mr. Henry E. Jones, is the Deputy-Chairman. Mr. Jones, it may be remembered, entered the Company's service just five years ago, on the retirement of Mr. H. S. Freeman, having previously been Engineer and Manager of the Isle of Thanet Gas Company; and he has discharged his duties with great efficiency. The announcement of his retirement was made at the recent half-yearly meeting of the Company, and was received with general regret. We trust that rest and entire relief from responsibility may have the effect of restoring him to a condition which will justify hope that he will again be able to undertake duties which he is specially qualified to discharge. During Mr. Jones's illness, the management was in the hands of Mr. H. O. CARR, and his services are being retained.

Mr. JAMES PATERSON, Assistant-Engineer to the Gloucester Gas Company, has been appointed Engineer and Manager of the Redhill Gas Company, in succession to Mr. Douglas Helps. Mr. Paterson, who is the son of Mr. R. Ormiston Paterson, Engineer and Manager of the Cheltenham Gas Company, was educated at Cheltenham Grammar School. He matriculated at Jena University in 1894, for one term, during which he studied chemistry, electro-chemistry, and physics. In October of the same year, he entered Clare College, Cambridge, where he had obtained an Entrance Scholarship in Natural Science, which was subsequently converted to a Foundation Scholarship. In June, 1897, he passed second class (honours) in Part I. of the Natural Science Tripos—taking as subjects chemistry, physics, physiology, and geology—and proceeded to the degree of B.A. Cambridge. At the end of that year, Mr. Paterson entered his father's office at Cheltenham; and twelve months afterwards he continued his pupilage with his uncle, Mr. T. Ormiston Paterson, Engineer of the Birkenhead Corporation Gas-Works. While at Birkenhead he attended a course of engineering at the University College, Liverpool, under Professor H. S. Hele-Shaw. In September, 1899, Mr. Paterson went to Gloucester as Assistant to the Engineer, Mr. W. S. Morland; and while he has been there considerable additions to the works have been carried out, including the erection of a gasholder and tank, condensers, scrubber, retort-bench extensions, &c. In 1901, Mr. Paterson took the degree of M.A. Cambridge.

At the works of the Hornsey Gas Company, last Saturday, the employees presented Mr. JOHN MITCHELL, the late Assistant-Manager, with a very valuable piece of plate, and a silver-mounted umbrella, as a token of their regard, and to congratulate him upon his appointment as Engineer and Manager to the Colney Hatch Gas Company. Mr. W. Ong, the oldest of the Hornsey Gas Company's servants, in making the presentation, aptly referred to the honour conferred upon him by his fellow employees in choosing him to perform this very pleasant task; and, in requesting Mr. Mitchell to accept the presents as an evincement of their esteem, he asked that he would also accept their hearty congratulations and good wishes for his future welfare. Mr. Mitchell, in a suitable reply, thanked Mr. Ong for his kind remarks, and asked him, and all his fellow employees, to accept his most grateful thanks for their kind and very valuable presents, which would be a lasting testimony to him of their appreciation. His hurried summons to meet them that day was the greatest surprise of his life, and, he could conscientiously say, the most pleasant surprise. He could assure them that their congratulations and kind wishes for his welfare gave him very great pleasure, and that the manner in which he had been made the recipient of their generosity enhanced the value to him of their presents beyond the bounds of any intrinsic worth. The ceremony closed with hearty cheers for Mr. Mitchell.

ESSAYS AND REVIEWS.

THE SYSTEM OF MUNICIPAL GOVERNMENT.

IN the last issue of the "JOURNAL," it was our unpleasant task to have to notice the first report of a Departmental Committee appointed by the Dublin Municipal Council to examine into the working of the different departments of the Corporation. The portion of the report then dealt with made it abundantly clear that a most extraordinary state of things pertains at the present time in connection with the public service of the city; and we propose now to refer as briefly as possible to the revelations contained in the remainder of the report, as well as to the recommendations made by the Committee with a view to putting an end to the unsatisfactory manner in which the work of the various departments is conducted. Next to astonishment at the existence of such a condition of affairs as the investigation has unearthed, must come a feeling of surprise that it has been possible for it to continue so long unchecked. But now that the Corporation have resolutely set themselves to put their house in order, it ought not to be too much to hope that the work of the Municipality will in future be conducted on lines more nearly approaching the general idea of what local government should be than has been the case with the course hitherto pursued.

The examination of the Water-Works Department did not reveal anything of a very startling character. It was shown that the store-keeping is carried out in a very slip-shod way, and that considerable improvement is possible in this connection; there being at present no satisfactory check on the supplies going into or out of the stores. One point, however, transpired in the evidence of Mr. W. B. M'Cabe, the Engineer of the Water-Works, which should not be passed over in silence. It appeared that until four or five years ago all the water-meters, of which the Corporation possess several thousands, were dispatched to Rotherham to be repaired, at a cost of £800 a year; whereas Mr. M'Cabe now does the work in Dublin, with a fitter, a labourer, and two boys. Under this arrangement, the cost to the Corporation is only about £400 per annum, including materials, while if the meters were sent to Rotherham as formerly the charge would amount to quite £1000 a year. Mr. M'Cabe naturally takes some credit to himself for having effected so considerable a saving; and this evidence of zeal must have been very welcome to the Committee of Inquiry in the midst of their dispiriting labours.

Passing on to the Cleansing Committee, it is stated that the manner in which the minutes of the meetings of the Committee are kept differs from the practice in the other offices, and economizes labour to a considerable degree. They have therefore been urging this system upon the Secretaries of the other Committees; but as the main object of these other departments seems to have been to find work for the clerks, so as to keep them all employed, the suggestion did not meet with the success it deserved. An amusing example of the business methods of the department was furnished in connection with the buying and selling of dust-bins. In the first place, the Committee have two contracts running—one with an English firm at a price of 3s. 5d. each, and the other with a Dublin firm who charge 5s. 6d. It was very good of the Supplies Committee to recommend the "supporting of home industries" in this manner; but apparently it was not expected that the ratepayers would be willing to pay the higher figure for the bins simply because they were Irish. The Committee therefore decided to charge a uniform price between the amounts paid for the two classes of bins, so as to recoup themselves; and the uniform price fixed upon was 3s. 6d.! Thus the Committee are making 1d. profit on each English bin sold, and losing 2s. on every Irish one disposed of. In this way, if they are to "recoup themselves," the Committee must sell 24 English bins to every one of Irish make. But it is not clear from the report that this is what they are doing. A visit by the Inquiry Committee to the Cleansing Committee's stores was not altogether satisfactory. Upon entering the office of the storekeeper, they found the man who was left in charge during the absence of the storekeeper on leave to be in a helpless state of intoxication, and had to at once order him to leave the premises. It transpired that he was formerly in charge of a division of scavenging; but the Committee reduced him some time ago. Nevertheless, he was regarded as a suitable person to temporarily discharge the duties of storekeeper.

Coming to the Lighting Committee, Mr. Thomas J. Cotton, the Superintendent of the Gas Department, was unfortunately on leave at the time the Inquiry Committee visited the offices. They, however, examined one of the clerks and an overseer, with reference to the keeping of the accounts and wages books. The latter stated that he had two tin-smiths doing the same class of work; but while one was paid 5s. 8d. a day, the other received only 3s. 4d. Asked for an explanation of the disparity between the wages of the two men, witness said that the cheaper one only worked three-quarter time for the Corporation all the year round. The Committee, however, were not satisfied, and directed further inquiries to be made into the matter. It was then found that the statements made by the foreman and clerk were wholly untrue. The man receiving £1 a week, and whose name appeared on the

wages-sheet regularly as being at work every day, had not done anything for the Corporation for several years. Mr. Cotton, in a subsequent explanation, stated that the man's sight failed him after seven years' service, and that when the matter was reported to the Committee, they ordered him to be continued in the service for two months. These two months expired on June 8, 1898; but—though no subsequent report or order could be found on the records, and though the man had not worked a day—he has been paid all these years as if he had worked full time, and has actually been led up to the pay office by a relative every week to receive his wages! As these facts must have been fully known, the Committee are certainly justified in making the statement that they cannot too strongly condemn the conduct of the foreman and the clerk in the deliberate misstatements and misrepresentations which they made on the matter. "That a man, however deserving, should be in receipt of a pension of this kind for years without the sanction or knowledge of the Committee having charge of the department, is a grave matter; but its gravity and danger are both increased by filling his name for full time into the wages-sheet every week, as it points the way to fraud and deceit." This is certainly putting the case as mildly as they possibly could, having due regard to all the circumstances. Here is another example of the peculiar business methods adopted. Only the wages-book relating to the work done for the Lighting Committee comes up for examination at the meetings of the Committee, whereas the list of wages paid in respect of labour done by the staff for other Committees is presented directly to the City Accountant, and never produced before the Lighting Committee. It was therefore impossible for them to know that a fitter whose time was charged in the weekly pay-sheet as 1½ days at 6s. per day, was also entered in another wages-book not presented to the Committee for the same week for 6 days at 6s. a day—he being thus paid for 7½ days in that week.

The Committee next proceeded to examine in detail the different wages-books presented for payment weekly at the City Treasurer's office. This resulted in the unearthing of a whole lot of men who are in receipt of regular pay, but who are totally unable, from various causes, to do any regular work. One of these men, though put down as working six days a week, was stated to go about on crutches, another has not for twelve years been to the depot where he is put down as working, while a third has for the past year sent his daughter to take his wages. It was, however, reported that since the Committee started their investigations several of these "pensioners" had been struck off the wages-lists, which caused the Lord Mayor to remark that such a course was unfair to him, as there was a report throughout the city that he was taking away from them their employment. It is, of course, impossible to conduct an inquiry of this kind without displeasing those who have unduly benefited from the existing state of affairs, but it cannot be imagined that the ratepayers generally will attach any blame either to the Lord Mayor or to the members of the Committee in regard to what they have done.

We come now to the recommendations offered by the Committee for the consideration of the Council as the result of their labours. In the first place, they are of opinion that economy and efficiency can only be secured by the erection of suitable offices where all the Committees and the principal officers can be in touch with one another. Each Committee should institute (and repeat annually) an inquiry into the working of its department, in the light of the evidence given in the report; and more responsibility should be cast on the Secretary of each Committee for the accuracy of the accounts, wages-books, and pay-sheets. The Secretary of each Committee should visit in the interval between one meeting of the Committee and another the principal works and offices under the control of the Committee, and report upon anything needing attention. They state that the system pursued by several heads of departments, of employing and dismissing workmen without any reference to their Committees, has led to extravagance and abuse, as well as grievous injury to the workmen themselves, and should be immediately discontinued. To secure permanency of employment to the more deserving of the workmen and labourers, and just treatment to all, it is essential that each Committee should strictly limit the permanent staff which is required for the ordinary operations of the Committee every day throughout the year. Casual labour, in addition to this staff, might be employed for any large or exceptional work, and dismissed on the termination of such work; but the wages of the two staffs should be kept separate. Vacancies on the permanent staff should be filled from the more industrious and deserving of the men who had casual employment; but they should be filled by the Committee themselves on the report of the officer in charge. No officer should have the power of dismissing a man who has once been placed by the Committee on the permanent staff; but this should not deprive any officer of the right to suspend for negligence or misconduct, pending the meeting of the Committee, anyone placed under his control. The power of promoting a man on the permanent staff, or altering his position or wages, should be strictly reserved to the Committee. No overtime should be allowed by any head of a department without the express sanction of his Committee; and any entry in a pay-sheet allowing for overtime in addition to the weekly wages should be specially initialled by the officer who certified the wages. Where one Committee charged another the cost of any work performed for it, this account should not be accepted by the Accountant until certified by the Committee to whose debit it was to be charged. In every report from a Committee referring to the acceptance of any tender for work or supplies, if the lowest tender was not accepted the Committee should state their reasons for rejecting it. Every Committee having control of any large body of workmen should depute one of its members, or the Secretary, to attend occasionally at the weekly payment of the staff. As no officer at the head of any department is likely to recommend or approve any economy involving the dismissal of a member of his staff, the Council and Committees should look to the non-filling of vacancies that might arise as the chief or only means of reducing the staff to its requisite strength. With this view, the Standing Order requiring a resolution setting forth the necessity for filling the office should be strictly enforced, and, where feasible, promotion to the higher vacancies should be confined to qualified officers of the existing staffs. Every application from an officer for leave of absence should be accompanied by a statement as to how the duties of the applicant were to be discharged during his absence; and, unless in very exceptional instances, the date on which the leave was to begin should be defined by the Committee when granting it.

These general recommendations are followed by others referring to each particular department. Into these it is unnecessary to go, as they deal mainly with routine matters, the reduction of the staffs, &c. It is recommended that an inquiry should be immediately instituted by the Improvements Committee with reference to the large number of men in the Sewers' Department who were reported as unfit for work, but who nevertheless were set out in the time-sheets as working every day; and that the men should all be seen by the Committee, and their cases carefully considered. Thus concludes the first report of a Committee whose work will long be remembered in connection with the system of municipal government as it exists at the present day. There still remain many important matters to be investigated; and these will be dealt with in a subsequent report to the Dublin Municipal Council.

OUTPUT OF COAL AND QUESTION OF PRICE.

The preliminary figures published by the Home Office relating to the output of coal in 1902 are very satisfactory to the coal consumer, and illustrate plainly the effect on the activity of the coalminer which is produced by a reduction in his rate of pay. The quantity of coal mined last year was the greatest on record, exceeding by over 2 million tons the output for 1900—which was the previous high-water mark—and showing an increase of no less than 8,141,000 tons over the total for 1901. In the year 1897, and also in 1898, the output was 202 million tons; in 1899, when the "boom" began, it rose to 220 millions; and in 1900 (which witnessed the culmination of the period of abnormal demand), the total exceeded 225 millions. The following year (1901), during the greater part of which the miners were in the enjoyment of very heavy rates of pay, the production fell to 219 millions; but last year, according to the figures now published, it rose again and reached the record figure of 227,178,000 tons. As, however, the exports of coal also rose to a higher total than ever last year, the increase in the quantity available for home consumption was not so great as that in the output; and, moreover, the exports of iron and steel (which represent so much coal used) reviving last year, the comparison requires a further adjustment, and may be put in this way: Increase in output of coal, 1902 over 1901: Absorbed in increased coal exports, 2,700,000 tons; due to increased shipments of iron and steel (say), 1,500,000 tons; available for home consumption, 3,941,000 tons; total, 8,141,000 tons. Increase, 1902 over 1900: Absorbed in increased coal exports, 2,207,000 tons; deduct for decrease in iron exports (say) 1,000,000 tons; available for home consumption, 800,000 tons; or a total of 2,008,000 tons.

Last year, therefore, it will be seen, there was more coal available for the home consumer—excluding the maker of iron and steel for export—than in either 1901 or 1900; and it says much for the soundness of trade at home that the collieries were able to obtain such good prices for their output during the year. They were, to some extent, assisted in this by the fact that the labour situation in the coalfields almost throughout 1902 was so uncertain, and at times so threatening, that buyers naturally preferred to err on the safe side in regard to the quantity kept in stock (we believe most gas undertakings ended the year with a very good supply of coal in store); while the actual outbreak of labour disputes in the coalfields of France and America just staved off a heavy "slump" in the English coal market at the beginning of the winter season. But, unless the ill-luck that has pursued the coal consumer for several years past plays him unforeseen tricks again, evidence accumulates to show that the inevitable further fall in the price of coal cannot be much longer delayed. The output figures furnish the latest ground for that belief.

The potential output of coal in the United Kingdom is steadily growing; the number of persons employed in mines showing an increase year after year. In 1902, about 3,000,000 tons of the increased output was due to the larger number of miners employed, the balance of 5 millions being due to improved output per miner; and if the number employed remains stationary during the present

year, the additions made in the course of 1902 should increase the potential output for 1903 by quite 2 million tons, while, if the output per miner were to return to what it was in (say) 1899, the total for this year would fall little short of 250 million tons. Of course, we do not anticipate any such output, as collieries do not stock coal indefinitely; but what we do confidently expect is that, as no owner is anxious to be the one to work his collieries short time, no one will find it policy to hold out for anything like current prices, if it is made evident by prospective buyers that they have no intention of paying them. The market at the present moment, it is true, is awaiting the outcome of the latest developments in South Wales negotiations; but as, in the first place, we shall not (for reasons explained elsewhere) believe that a rupture will come about now until we are forced to do so by the actual occurrence, and as, in the second place, there is not the least hurry for any buyer to enter the market, this fact may, in our opinion, be left out of account at present. What the coal buyer needs to remember is that the output is large, and is increasing; that the home consumption is not more than normal, and shows no signs of exceptional increase; that the foreign demand is not likely to prove materially heavier than, if as heavy as, in 1902; and—that everything comes to him who knows how to wait!

ELECTRIC LIGHTING MEMORANDA.

The Special Meeting of the Marylebone Borough Council to Deal with the Electricity Undertaking Award—The Prospects of the Affair—Mistaken Views—Is the Award Unjust?

THE first stage of the development of the situation created in Marylebone by the award of the Arbitrators in respect of the proposed municipalization of the electric lighting of the borough has been taken. The special meeting of the Borough Council to consider the award was held last Thursday, when the Lighting Committee submitted a recommendation that the Council should apply to the London County Council for their sanction to the borrowing of £1,274,000; this sum being the amount awarded to the Company, with costs. To this was added a recommendation for the authorizing of expenditure during the next ten years of £400,000, exclusive of the cost of the site, for the erection of a generating station and the consequent expenses, including those of the conversion of the whole of the supply to continuous current, not yet completed by the Company. It could not be said of the Lighting Committee that they shirked the responsibility put upon them by fate and circumstances, or sought to minimize the extent of the commitment of the ratepayers which it was their official duty to recommend. Mr. Debenham, the Chairman of the Committee, bravely endeavoured to show that the course proposed is compulsory, and that there is no way out of it. He stated that the affair is a consequence of the acts of the Council's predecessors, and the only alternative would have been to allow a huge and most inefficient monopoly to be established which they would not have been able to purchase at the end of the statutory period.

Both Mr. Debenham and his seconder, Mr. Garrould, held out the flattering hope that, although there would be a loss on the conduct of the undertaking if the current had to be brought from the bulk manufacturing station of the Company at Willesden, as soon as their own local generating station was erected there would be a profit of £15,000 per annum, instead of a loss of £40,000. Unfortunately, nobody had a word to say on behalf of the consumers, who would never get their electricity a farthing cheaper by reason of the burdening of the ratepayers by this onerous transfer, while the other customers of the Company outside the borough would derive all the benefit of the reduction of the Company's capital by the realization of the goodwill of the Marylebone portion. In the event, an amendment to the recommendations of the Lighting Committee was carried, referring the matter back to the Committee, with an instruction to get further Counsel's opinion as to the possibility of the award being annulled or modified, and as to what the consequence would be if the award were not carried out by the Council. This declaration, which was tantamount to quashing the whole affair, was adopted as the substantive motion by the significant vote of 29 to 6; so that there does not appear to be much ground for thinking that the Council will ever approve of the action of their Lighting Committee.

As we have already remarked in previous comments upon this unfortunate business of Marylebone, the story is of supreme interest as furnishing a test for the much belauded "principle" of the municipalization of this order of public services, which Progressive municipal politicians have ridden to its death in this important Metropolitan borough. Obviously, if there were any such principle, it would not be affected by any consideration of local or time-governed expediency. Sir Thomas Brooke-Hitching is reported as saying that if Parliament had been able to foresee the award, it would never have given the Council permission to assume this undertaking. This, with all respect be it said, is nonsense. An arbitration is the approved and the only way of ascertaining the amount of compensation due to an owner of property who is required to relinquish possession, not of his own free will, but for the public good. The question of whether it is for the public good that he should be expropriated, with proper compensation, is one for prior decision by the wisdom of Parliament, which is not swayed by any knowledge of what the amount of compensation will be. Those who propose the course are supposed to be prepared to abide by all the consequences. There was never any such thing known as an arbitration to value an option of purchase.

Sir T. Brooke-Hitching went so far as to stigmatize the award in the present case as unjust. That is matter of opinion. Probably no pair of litigants ever agreed as to the justice of a decision upon their conflicting claims; so there is nothing new in this way of thinking. All such opinions are, however, of the nature of the wisdom that follows the event. What a headstrong, or prejudiced local authority imagining it has to do with a "grasping and inefficient monopoly" can learn from the Marylebone example, is the danger of acting upon such preconceived ideas, and the absolute necessity for making sure that nothing can arise of the nature of a detail, or a necessary consequence, to upset a parliamentary decision that rests upon the proof of expediency. It is notorious that public bodies allow themselves to be swayed by a few strong-minded individuals, and are not always careful to distinguish fancies and popular catchwords from facts. It is a great misfortune when corporations get into a habit of repeating catch words originating nobody knows how, but perhaps assiduously kept in circulation by "topical" newspaper reporters, to the disparagement of the local railway, or gas supply, or electric lighting, with which the people of the neighbourhood have to serve themselves. It is a trick which takes the fancy of the groundlings; but it is not they who have to pay for any blunder that may be committed in the way of taking a cry of the mob for the voice of fairness and reason. Substantial men of affairs who have permitted themselves to be led away by the cry of "monopoly," which is so easily raised, and almost seems enough to prove a case by itself, must feel intensely mortified when they perceive that they have fallen into the folly of those who set about building a lofty tower of public enterprise without first sitting down and counting the cost. That is what is the matter with the present minority of the Marylebone Borough Council, who find themselves left a helpless handful of six, to face a clamour which others besides themselves were instrumental in causing. The lesson will not be thrown away.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 574.)

THE general condition of things on the Stock Exchange last week showed some improvement, and one or two departments had a distinct advance; but, taken all round, there were a good many ups and downs. Consols were weak, but not unaccountably so. The American Market receded; while Home rails had a nice rise. Profit-snatching checked liberal advances; but the cheerful feeling was not impaired. The volume of fresh business was restricted to some extent by the fortnightly settlement; but this was not a heavy one, and was successfully negotiated. The Money Market was very firm in the face of a brisk demand for Stock Exchange and month-end requirements, and discount rates closed steady. Business in the Gas Market again presented a very moderate array of transactions. It opened with a fair promise of activity; but this rapidly dwindled away to small proportions, and the close was very quiet. The general tendency was firm and steady. Few changes in quotations occurred, except a goodly number of variations on *ex div.* adjustment; but they were all in the upward direction, with one marked exception, which is attributable to its own special circumstances. The most recent statements of accounts of companies for the second half of 1902 agree with the earlier issues in showing that it was a prosperous period everywhere. In Gaslight and Coke securities, business was not up to a fair average. The ordinary changed hands almost every day at very level figures, which did not stray outside 83-84¼. The secured issues were proportionately rather more active; but the prices were not buoyant. South Metropolitan was only very moderately dealt in; but the tendency was good enough to put the quotation up a point. Nothing at all was marked in Commercials. The Suburban and Provincial group afforded their fair share of the operations, though that did not amount to much; and their general position was steady. Brentford advanced a point, and, in the local Exchange, Sheffield had a larger advance. Among the Continental Companies, Imperial and Union alone were dealt in. The former barely maintained its position; while the latter was a prey to further depression, changing hands once as low as 119, and the quotation had a drop of 5 points. Nothing occurred in relation to the remoter undertakings that calls for notice. Business in the Water Companies was as quiet as ever, and prices dropped. Kent old relapsed in view of the termination of back-dividends; but why the new should also have gone back is not so apparent. Southwark also was lower.

The daily operations were too restricted in volume and too level in character to note further. In Water, Southwark "D" fell 5 on Monday. On Wednesday, South Metropolitan rose 1. On Thursday, Continental Union receded 5. On Friday, Crystal Palace, which had been rather favoured on *ex div.* quotation, was more nearly adjusted by a reduction of 1.

INAUGURATION OF THE NEW GAS-WORKS AT GRANTON (EDINBURGH).

With due civic ceremony, and all the proper attendant circumstance of such an occasion, the first section of the new gas-works at Granton of the Edinburgh and Leith Gas Commissioners was formally inaugurated last Friday, in the presence of the governors of the "Grey Metropolis of the North," with many representative citizens, and a considerable number of guests. The occasion and the character of the works were worthy of the most dignified function and the heartiest introduction into service; for are not these the beginning—and a huge beginning too—of the gas-works that will in future rise section by section, and concentrate on the extensive tract of land that has been acquired by the Gas Commissioners perhaps the whole of the gas-producing plant necessary to serve the great and increasing populations of Edinburgh, Leith, and the surrounding district? What will Granton then be? The status of Beckton and East Greenwich will diminish in the eyes of the gas profession when that time arrives—especially of those members of the fraternity who journey here from abroad, and whose souls appear to be possessed with the one main purpose of seeing the wonders of Beckton (limited largely to its size and its chemical works) and of East Greenwich. The time when Granton will assert its claim to be of those great conglomerations of works which are in the front rank in point of output from a single site will assuredly come. The same reasons that brought about the beginning of the concentration of the gas-works of the Edinburgh and Leith Gas Commissioners will still obtain, perhaps in even greater degree, as time proceeds.

Let us see. The average increase in the annual demand for gas prior to the introduction of electricity into Edinburgh in 1895 was at the rate of 3·3 per cent. per annum. Since 1895, the rate of increase has averaged 3·6 per cent. per annum. The average increase in the gas supply to the Commissioners' area since the introduction of electricity in 1895 has been 51 million cubic feet per annum. This quantity is equivalent to the annual supply to a town of the size of Galashiels. The total increase since 1895 has been 357 million cubic feet. This quantity represents the annual supply to a town of the population of Paisley. Such rapidly growing claims upon any undertaking of necessity call for broad and comprehensive consideration of the future, based upon the experiences of the past. The difficulties under which the demands were met in the winter of 1896-7 by the various manufacturing stations of the Commissioners were such as to necessitate a thorough investigation into their respective conditions and capacities, with the view of ascertaining in what way the probable future requirements were to be met. This the present Engineer (Mr. W. R. Herring, M.Inst.C.E.) dealt with soon after his appointment, which took place in the spring of 1897. It may be said that the undertakings were declared to be not only incapable of meeting the increasing consumption, but, in many respects, they were ill-adapted to modern circumstances—in fact, the whole of the manufacturing stations had arrived at that stage of their existence when a complete reconstruction was imperative. Such being the case, then, notwithstanding the completion of this first section of the works at Granton, the same reasons which operated in favour of the beginning of the construction of this section will, in time, operate again in favour of the taking in hand of succeeding sections.

We need not here trace the proceedings that led up, under Mr. Herring's initiative, to the fixing of the site of the new gas-works in 1897 at Granton, nor allude, excepting in passing, to the negotiations that resulted in the provisional agreement to purchase from the Duke of Buccleuch, for the sum of £124,000, the 106½ acres of land constituting the site. All this has from time to time been recorded in the "Journal;" but there is just one outstanding feature which we should like to mention in connection with the huge amount of work that has been done at Granton, and that is the hearty and (we may even go so far as to say) sympathetic co-operation that Mr. Herring has received, in the consummation so far of the big undertaking, from the Gas Commissioners. Work of this description involving such considerable expenditure, so much detail, and so much organization—all centred in one responsible and advising head—runs easier and smoother for him when there is this amicable and confidential relationship on the part of those having superior power. Friday was indeed a proud day for Mr. Herring, when the Commissioners and other city dignitaries rejoiced over his accomplished work.

The engineering account of these new works (illustrated by plans and numerous photographs) which is now appearing in the "Journal" from the pen of Mr. Herring renders unnecessary a very elaborate description on the occasion of this inauguration of the first section; but at the same time it will perhaps be of interest and a convenience to some readers to bring within the compass of a few columns of one "Journal," a general outline description, and omit for one week the usual instalment of Mr. Herring's serial contribution.

We may preface the present descriptive account with one or two interesting explanatory and informative points. The foundation-stone was laid on Oct. 16, 1899, by Mrs. Mitchell Thomson, wife of the Right Honourable (then) Lord Provost of the City of Edinburgh, in the presence of the Commissioners and a large assemblage of the representatives of public bodies. A bronze tablet has been inserted in the south elevation of the main block of buildings commemorating this event, on which is inscribed a record of the event and the names of the principals acting on that occasion, the Commissioners, and their officials, together with a list of the documents contained in the casket sunk in a cavity in the concrete beneath the foundation-stone. Gas-making operations were commenced on Oct. 21, 1902; and up to the middle of February, 1903, 52,300 tons of coal were used for the production of gas. However, for various reasons, principally owing to the season of the year, the formal opening of the works was deferred until last Friday, when Mrs. Steel, wife of the Right Honourable the Lord Provost of the City of Edinburgh, graciously unveiled a bronze tablet inaugurating the completion of the works, on which is inscribed a record of the event, the names of the principals acting on the occasion, together with a list of the Commissioners and their officials, as well as a notification that at the same time Mrs. Mackie, wife of Provost Richard Mackie, of Leith, kindly undertook to unveil the corresponding tablet commemorating the laying of the foundation-stone.

Two other general points should also be included here, before giving the descriptive matter: The estimated cost of equipping the Granton site with a gas-works of the capacity now erected, was calculated to be £450,000; the cost of the products works not being included in the original estimate. Up to the 14th ult., £438,928 had been spent. There are some contracts still to be adjusted and balanced; but there is no doubt that this section of the works will be finally completed within the originally estimated sum. It is also worthy of record that, notwithstanding the fact that some bold innovations have been introduced, and the construction is on a scale larger than has hitherto been undertaken in one section, it has nevertheless turned out a gratifying success, both from an engineering and a commercial point of view.

Before concluding these introductory notes, mention ought to be made of the beautifully prepared and illustrated account of the works which Mr. Herring had written and edited, and which, while forming an elegant souvenir of the occasion, is equally attractive for the interesting information that fills it from cover to cover.

A General View of the Works.

In making this general descriptive survey of the works, readers will be assisted by referring to the ground plan of the works which we published in the "Journal" for Jan. 6. It shows in a sufficiently explicit manner the intention of the Engineer with regard to the ultimate occupation of the whole of the site, while at the same time leaving the future sufficiently untrammelled to permit of any possible development in the methods of gas manufacture.

The railway system has been laid in a manner so as to avoid as far as possible any confusion with the traffic; the coal deliveries being drawn from the sidings upon the eastern boundary, and transmitted first in a southerly direction and delivered on two lines of sidings between the coal-store and the retort-house on the west side of the latter. At a point on a line with the centre of the retort-house, the coal handling, breaking, and elevating appliances are fixed; the discharged or empty waggons passing forward in a northerly direction into the coke yard, where they come into position ready for being loaded with coke or refuse, or, in the event of the orders for coke being insufficient for the quantity being produced, they simply pass the screens and go out as empties.

The retort-house measures 386 feet long by 100 feet broad, and is covered by a semi-elliptical girder roof. It is equipped with four benches of inclined retorts, each bench consisting of fourteen settings of 9 retorts each. Each setting is provided with a self-contained producer and separate hydraulic main, with automatic tar overflow to ensure a liquor seal; the gas discharging immediately into a steel foul main, from the bottom of which, opposite each hydraulic main, a branch communicating with a tar-pipe is connected—the 6-inch tar-pipe running the full length of the bench and dipping over the end of the retort-bench into a syphon pot, from which the effluents flow, by gravity, into the tar-well.

Each bench is provided with a foul main condenser, secreted within the haunch of the circular girder roof, consisting of a coil of seven lines of 20-inch diameter steel tubing, 200 feet long, with an area of 1000 superficial feet, through which the gas is made to pass in a direction opposite to the flow of the condensed matters, which travel backwards and descend into the seal-pot at the end of the bench. The hot gases are therefore, immediately upon leaving the bench, brought into contact with the comparatively cool lighter tar deposited in the foul main condensers, by which means naphthalene, if present, is absorbed.

The settings are 12 feet centre to centre of the division walls, the division walls being 2 feet thick. The regenerative furnaces and settings are constructed to the design originally erected experimentally at the New Street Works. The section of the retort is one with outwardly sloping sides; this section preventing the expanding charge in the retort from wedging beneath the curve of the crown of the same. The settings are strongly stayed on the drawing stage front by means of H steels stretching from buckstay to buckstay. The upper ends of the retorts are, however, free to move outwards—no cross stays being introduced.

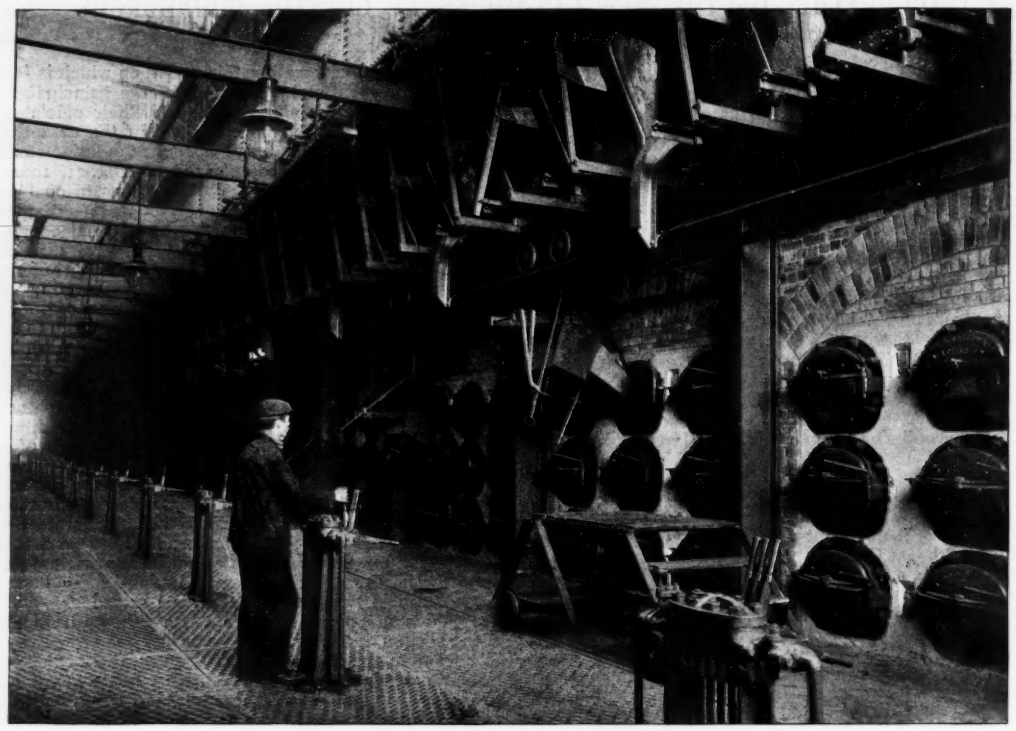


FIG. 1.—THE METHOD OF CHARGING THE RETORTS.

The fronts of the retort settings, both top and bottom, are lined with asbestos non-conducting material 1½ inches thick, to prevent the radiation of the heat and to protect the men. A plate is also inserted inside the top and bottom mouthpiece doors, with a packing of asbestos non-conducting material between the plate and the casting of the door, for the same purpose.

The benches are fitted with a continuous overhead hopper, having 16 hours storage capacity, fed by four lines of longitudinal conveyors. The hoppers are divided in such a manner as to permit of various classes of coal being carbonized separately—common coal, cannel coal, or shale being divided off over each setting. Beneath the coal-hoppers, measuring chambers are fixed, with adjustments in the same for varying the charge from between 5 to 8 cwt. The base of the measuring chamber is fitted with a balance-flap device, which prevents the operator putting in other than the exact charge for which the chamber may be adjusted. The chambers are also fitted with a regulating valve, which proportions the area of the aperture of discharge to suit the varying characteristics of the coal that may be used from time to time.

The slides are actuated by a new device. Instead of the old hand lever, with its necessary additions to the structure between the benches, the slides of the measuring chamber are in this instance worked by means of a small hydraulic cylinder with a compound valve, fixed upon the centre of the stage. The operation of charging the retort consists of bringing into position a portable shoot, the insertion of the shoe into the mouthpiece, and the movement of a lever of a hydraulic valve. (Fig. 1.) The balance

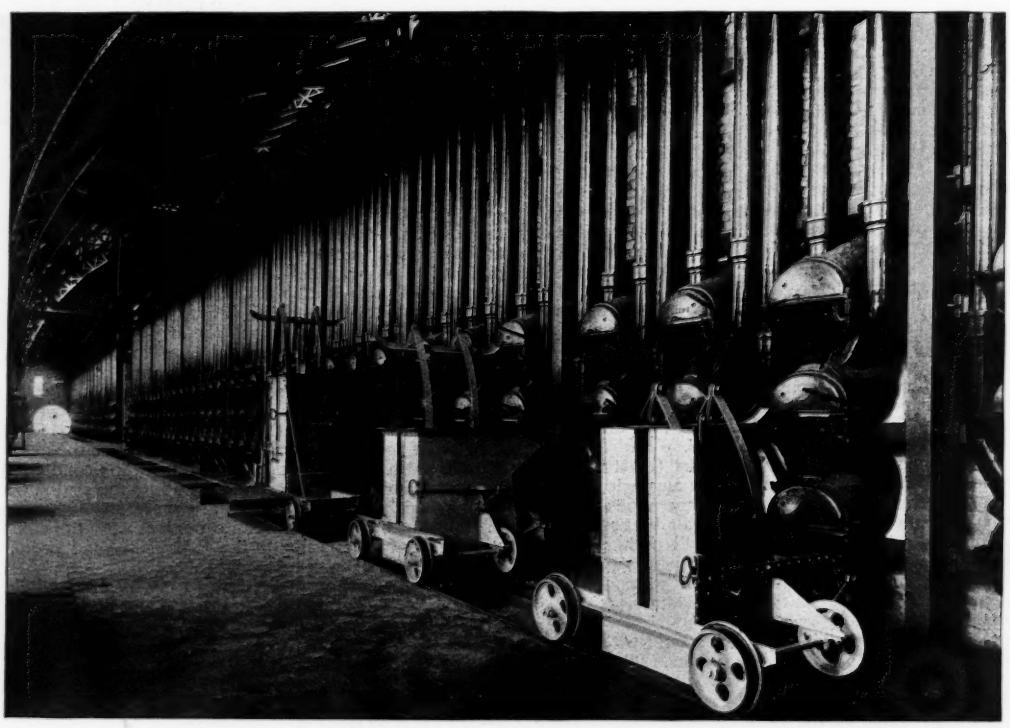


FIG. 2.—RETORT-HOUSE DRAWING STAGE, WITH COKE SHOOTS IN POSITION.

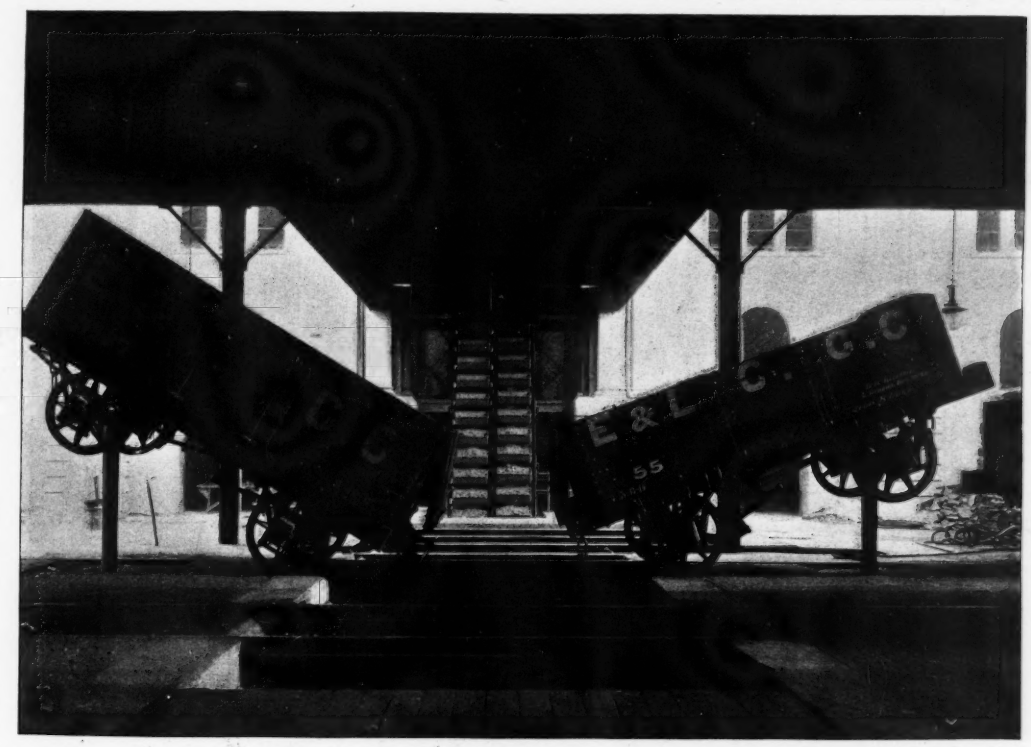


FIG. 3.—WAGGONS DISCHARGING COAL INTO A HOPPER, WITH MOVING BOTTOM FEEDING BREAKERS AND ELEVATORS.

(Maximum Capacity, 500 Tons Per Hour, with Four Waggons Tipping.)

flap referred to prevents any coal discharging down the shoot before the top slide of the measuring chamber is fully closed; and thus bye-passing and unequal charges are avoided. When the bottom valve of the measuring chamber is fully opened, the balance-flap falls into the opening thereof, the coal begins to fall down the shoot, the operator releases the lever of the hydraulic valve, and, owing to the constant pressure on one side of the piston, closes the slide hard upon the balance-flap—thus enabling him to attend to the portable shoot. Upon the retort being charged, the operator returns to the valve, releases the pressure against the balance-flap, which again swings upwards, and by the letting go of the hydraulic lever altogether, the constant pressure on one end of the cylinder closes the bottom slide of the chamber, at the same time opening the top one—the coal filling the chamber ready for the next charge. The physical exertion required on this stage as compared with the hand-lever is now reduced to child's play; the most serious operation being the opening and closing of the mouthpiece doors.

Descending from the stage between the benches, we arrive at the drawing stage—one on each side of the retort-bench. The house on each side is fitted with a coke-conveyor of Graham's type, consisting of a deep cast-iron trough in which is running a double chain composed of manganese steel links with chilled steel rollers running upon a roller path—the chain being protected by

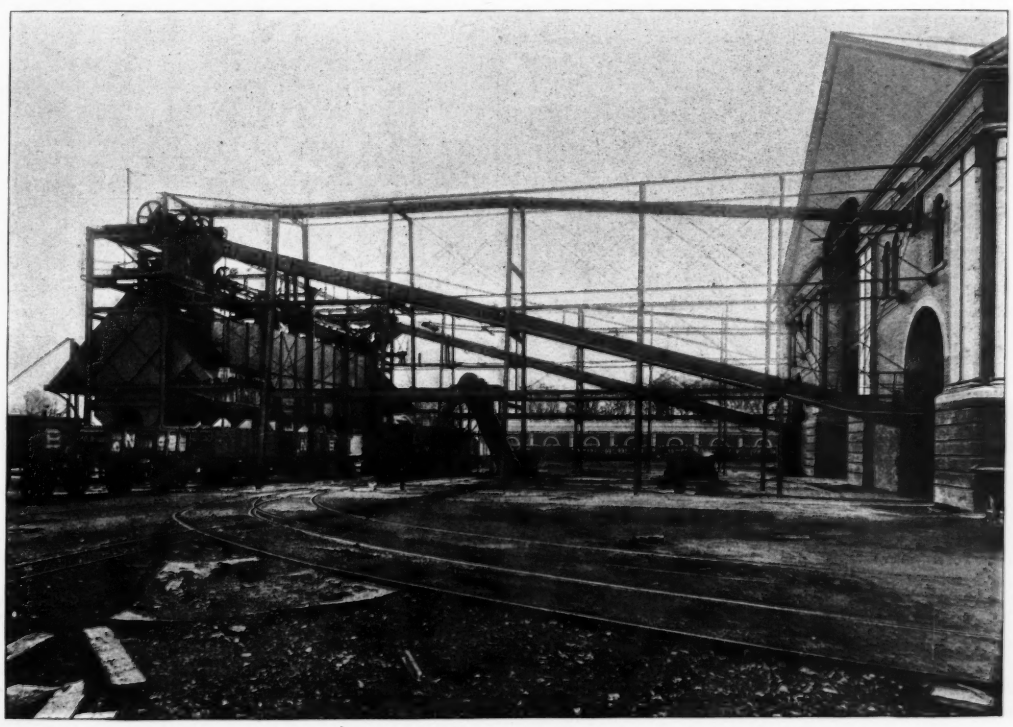


FIG. 4.—HOT COKE CONVEYORS, STORING, SCREENING, AND LOADING PLANT.

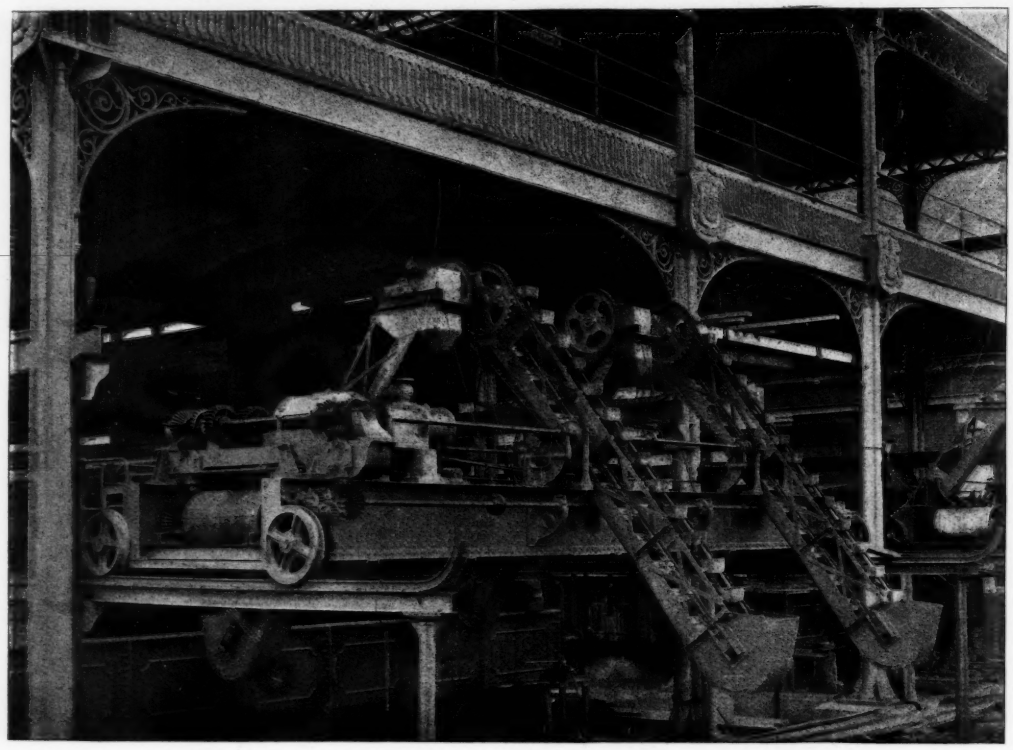


FIG. 5.—APPARATUS FOR DISCHARGING SPENT MATERIAL FROM THE PURIFIERS.

suitable deflecting plates. The chain is connected together by means of L-bars 1 ft. 8 in. long; these bars acting as conveyors for the coke.

The trough of the coke-conveyor is partly permanently covered and partly covered by portable covers. Arrangements are made beneath the permanent covers for feeding water to quench the coke traversing the trough of the conveyor. At the north end of the retort-house, the conveyor assumes an angle rising at about 30°, where the coke is discharged—either over screens for loading waggons, or into the coke-bunker, which is sufficient to hold one night's production of the maximum make, from which it can be either loaded into waggons or carts, or into skips for depositing in the yard. In the event of it being necessary to store coke, the bodies of the tipping waggons are removed from their frames, brought beneath the spout of the coke-hoppers, filled, hoisted again by means of a steam-crane, and landed on to their trolleys, already resting upon a light railway upon the top of the coke heap, where they are propelled by hand and tipped. After experience has been gained as to the quantity of coke likely to be handled for storing, if it will pay, automatic mechanical appliances will be put in for handling it.

The drawing of the retorts is a considerable improvement in

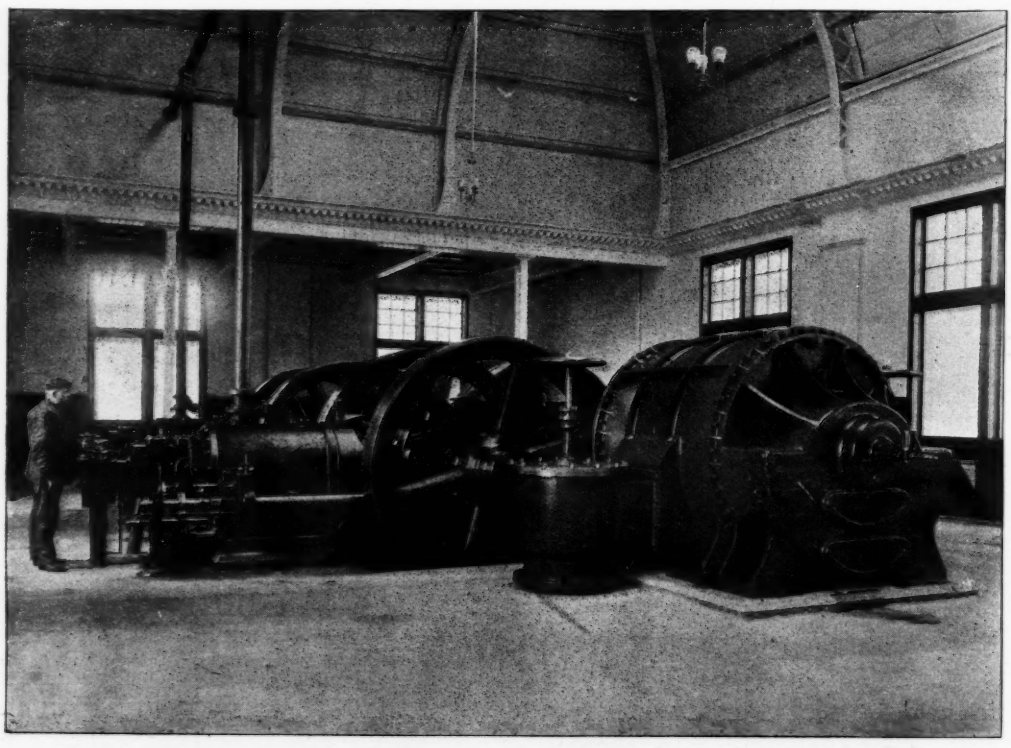


FIG. 6.—PUMPING MACHINERY FOR PROPELLING GAS TO EDINBURGH, LEITH, AND PORTOBELLO.

(1½ Million Cubic Feet Per Hour.)

this installation above all others. In the first place, means are adopted for securing the mouthpiece stopper. Instead of this being removed from the retorts and thrown on to the stage as heretofore, by means of a traversing discharging shoot the stopper is held in position ready for being inserted in the same retort when drawn. (Fig. 2.) Running upon rails immediately over the coke conveyor, a shoot has been fitted, which enables the coke falling from the retort mouthpieces to be directed either into the conveyor beneath, into the producer, or into an opening through the stage floor, where it would discharge into waggons beneath in the event of the coke-handling plant not being at work. The shoot is so arranged as to enable the easy withdrawal of the mouthpiece stop from the mouthpiece and its suspension just clear of the falling charge, where it is ready for reinsertion immediately the coke is discharged. At the same time, the shoot protects the men from the radiated heat of the discharging coke, and very considerably modifies the expense hitherto involved in the repairs and maintenance of the retort mouthpiece stoppers.

The coal-handling arrangements at Granton may be said to be automatic. Waggons are tipped or emptied of their contents by raising the hind axle and discharging by the end door; or, in the case of ordinary bottom door waggons, or modern 40-ton waggons, by releasing the bottom and the contents discharging on to a hopper. (Fig. 3.) Four waggons can be discharged simultaneously into the same hopper; the bottom of which is made to traverse, at a varying rate of speed, according to the quantity of coal required, in the direction of the coal-breakers. After passing the breaker, the coal is elevated by one of two 30-inch bucket elevators to a point 70 feet above the retort-house level, where it discharges into one of two 30-inch push-plate conveyors, which, in turn, are made to feed one or all of the four 18-inch push-plate conveyors fixed upon the storage-hoppers, which, in turn, feed and fill the coal-bunkers previously referred to. From beginning to end, therefore —from the unloading of the coal and the manipulation of the same to its discharge as coke, loaded into waggons—the work is entirely done by mechanical appliances, requiring a minimum of personal attention.

Messrs. Graham, Morton, and Co., Ltd., of Leeds, were entrusted with the contract for this entire plant, including the coal and coke handling machinery. (Fig. 4.) They have not only achieved a record in rapid constructional work of this character, but they have also greatly enhanced their reputation as a firm of specialists with this class of work.

The gas upon leaving the retort-house is made to converge in two sections or streams, and thereafter can be made to flow as one or two streams through two sections of plant, each of which is designed to deal with 5 million cubic feet of gas in twenty-four hours. At the end of the retort-house, the four lines of 20-inch pipes from the foul main condensers converge each two into a separate 30-inch main; each of these 30-inch mains communicating with a battery of water-tube condensers.

The water-tube condensers are of Messrs. Clapham's make; the syphon pots in connection with these being carried outside of the building, and sealed in the open air. The water used in these condensers is the supply from the service-tanks to the works. The gas on leaving the water-tube condensers, still in two streams, is conducted to the exhauster connections suspended beneath the floor of the exhauster house, which are arranged in such a way that gas can be made to pass through either set of exhausters separately or jointly.

The exhausters are placed upon the upper floor of the machinery house, beneath which the engines, in duplicate, for driving the coal and coke handling plant are placed, as well as the hydraulic pumps for working the hydraulic capstans and lifts throughout the works. The exhausters are of Messrs. Laidlaw's latest type, wherein the capacity of the inner drum is taken advantage of.

Each set of exhausters is arranged in pairs, with an engine between each. Each engine is sufficiently powerful to drive all four exhausters at full load, and by means of strap driving can be made to drive any one, or more, of the exhausters on the opposite set to itself, or the engine of one set can be made to drive the exhausters on the opposite set only, by means of an arrangement of strap driving and couplings.

After leaving the exhauster house, the gas flows in two streams to the plant house, where the Pelouze and Audouin condensers and the washer-scrubbers and cyanide plant are contained within a portion of the north-end of the coal-store block. The basement of this building is sunk 6 feet below the yard level, so as to permit of the connections lying fully exposed upon the same, together with the inlet, outlet, and bye-pass valves; the syphon and connecting pipes in connection with these being carried to the outside of the building, and there sealed in the usual way.

The gas is first made to enter the Pelouze and Audouin condensers, which are of an American type supplied by Messrs. W. C. Holmes and Co., of Huddersfield. It afterwards passes through the washer-scrubbers, which are also of Holmes's latest patent—each being 12 ft. 6 in. diameter by 22 feet long.

The first four chambers of the scrubber are used as a washer, wherein the weak liquor from the hydraulic mains and condensers is brought up to commercial strength, as well as the fullest advantage taken of its alkaline properties for the removal of sulphuretted hydrogen and carbonic acid. The remaining eight chambers are used in the ordinary way—clean water being allowed to run in at the end where the gas leaves the scrubber. The weak liquor from the hydraulic mains and condensers is collected in a tank beneath the ground opposite the building. The tar is there separated, flowing by gravity to the products works. The liquor is pumped from the tank through a cooler, to bring it down to a normal temperature, and into the washer chambers of the scrubbers.

The cyanide plant consists of two of Messrs. Holmes' washer-scrubbers, 12 ft. 6 in. diameter by 22 feet long, through which the gas is made to pass immediately after leaving the ammonia washers. The apparatus for the treatment of the fluids used and obtained in connection with the cyanide recovery process has also been supplied by Messrs. Holmes and Co., of Huddersfield. Provision is made for working this plant for the recovery of the cyanogen compounds, either as sodium ferrocyanide cake, potassium ferrocyanide crystals, or calcium ferrocyanide solution; the latter being the process first to be worked.

The gas on leaving this building is conducted through two lines of 30-inch mains to the purifier-house, where an arrangement of valves has been put in to permit of the diversion of the streams into either section of purifiers—the same as preceding the exhausters and also the plant house.

The purifier contract was let to the Barrowfield Iron-Works, Limited. The purifiers are of the water-lute type, in two sections, each of six boxes, 45 ft. long by 30 ft. broad by 6 ft. 6 in. deep; the boxes having continuous lutes and division plates common to both. Each section of six is worked with an eight-way Weck's valve to four boxes, and a four-way valve to the two subsequent boxes.

The contracts for the purifier-house, as well as for a very large quantity of the structural steel work, including the coal-store and exhauster house roofs, floors, &c., were let to Messrs. Redpath, Brown, and Co., Limited, of Edinburgh.

The purifiers are placed upon the ground floor, with a revivifying floor overhead supported on columns. On either side of the purifiers, a line of railway is laid upon a low level, so that the contents of the boxes can be discharged into the waggons on either side.

A special mechanical device, on the dredger principle, has been designed for discharging the material from these boxes; and the filling of the same is accomplished by discharging the lime or oxide through holes in the upper floor, whence, by means of canvas shoots, it is laid into position in the box. (Fig. 5.)

The central gangway between the two lines of purifiers has a continuous gap in the floor above. Within this gap, running on rails supported from the upper floor, two traversing elevators are provided. The discharging apparatus previously mentioned is reversible. The material can be loaded either into waggons on the low-level railway, or into the boot of the traversing elevators referred to. These elevators discharge into a distributing conveyor running above the upper floor. The upper floor is protected by a roof supported upon columns.

The station-meters (Messrs. R. Laidlaw and Son, makers) are of the ordinary type, contained within cases of special design. Immediately on leaving the meters, the gas enters the gasholder inlet. (Fig. 6.) This holder is constructed in a comparatively speaking shallow tank; the proportions of the diameter to the depth being 7 to 1. There are four lifts, with a total capacity of 7 million cubic feet. The contract for this was secured by Messrs. Clayton, Sons, and Co., of Leeds. They also made the retort-house roof, &c.; and one cannot speak too highly of the character of their work or their methods in executing the same.

The pumping-station is an important feature at Granton. Probably the largest exhausters of the rotary type are to be found there, used in connection with the pumping of the town gas supply. These have been made by Messrs. Laidlaw. They are driven by means of a 125-horse power Grices' (Birmingham) gas-engine; the power being transmitted from the engine to the exhausters by means of frictional gearing arranged in such a manner that the gas-engine, running light, is first set to work with the friction pinion upon the crank shaft of the same, thereafter the large driving wheel is put into gear with the friction pinion, the exhausters being finally coupled by means of a friction clutch. The plant is in duplicate, and each is designed for the transmission of 750,000 cubic feet of gas per hour at a normal pressure of 5 lbs. to the square inch. The present hourly requirements for the lighting of the district is 1 million cubic feet of gas during the heavy lighting period.

The connections in the pumping-station have been arranged in such a manner so as to deliver any quantity of gas per hour up to the maximum by means of bye-pass valves on the 48-inch main; the speed of the engines being constant. (Fig. 7). The connections have also been arranged to permit of the exhausters being employed for sucking gas from the New Street Gas-Works, or delivering it from Granton to the former. The pumping plant delivers through a 48-inch main to the gasholder stations in various parts of Edinburgh, Leith, and Portobello, the extreme distance being 8½ miles.

Coal-stores are provided in the works under cover for about 15,000 tons of common coal; these stores being filled by mechanical appliances, which enable one man to comfortably handle 200 tons of coal in ten hours. Large storage of cannel is provided for in the open yard, where permanent walls enclosing the stock have been built of cannel; and as occasion requires it, stock from the interior of the enclosures will be removed, leaving the walls intact as a last resource.

The steam generators are of the Stirling boiler tubular type, and have been fitted with furnaces for firing on the gaseous system; the producers being of an exactly similar type to the retort-house producers, with special arrangements internally in the boiler setting for the combustion of gas in the presence of the comparatively cool portions of the boiler-tubes. By this arrangement, it has been possible to continue the flame obtained from producer gas generated from coke throughout the complete setting to the root of the chimney.

Adjoining the boilers, the plant for the manufacture of briquette fuel from the coke dust is installed. The high price of pitch during the past few months, however, has not been a great inducement to pressing forward with the general introduction of this fuel. Sufficient, however, is being made to introduce the briquettes to home and foreign markets, and valuable experience is being gained as to the best means of developing this part of the products market.

The block of buildings on the eastern boundary, consisting of workshops for joiners, blacksmiths, mechanics, &c., as well as locomotive sheds, are equipped with forges, power hammers, punching and shearing machines, drilling machines, lathes, screwing machines, &c., &c., such as will enable the staff to meet with any set of conditions that may arise in consequence of the very large application of mechanical appliances.

The products' works are situated upon a lower level of the site near the shore, and are equipped with sulphate of ammonia plant, and plant for the production of liquid ammonia, chloride, muriate, and nitrate of ammonia; the capacity of the plant being equivalent to 200 tons of liquor per day.

In conclusion, it is only necessary to say that the Commissioners, under their Engineer, carried out the greater part of the excavating and levelling work, the laying of railways, and the foundations and concrete work, in connection with the various structures. This course was determined upon at the suggestion of the Engineer, in consequence of the delay that threatened to take place in the completion of the works in the early start.

A most careful and elaborate system of costing was introduced in order that an exact record could be kept of the relative cost of the work done by contract under schedule rates and work done by the Commissioners themselves. The retort-house and coal-store blocks of buildings were executed under a labour contract only; the Commissioners providing the whole of the building materials, scaffolding, &c. The remainder of the buildings on the works were constructed by the Commissioners.

The Inaugural Ceremony.

The opening ceremony was carried through in a furious gale from the south-west, which beat with great severity upon the southern gable of the exhauster-house, where the proceedings began. So pitiless, indeed, was the buffeting of the wind, that it would have been impossible to hear what anyone might have attempted to say in public; and, as a matter of fact, with the exception of a few introductory words by Provost Mackie, of Leith, who presided in the absence of Lord Provost Steel, of Edinburgh, through illness, remarks were held as said, and the proceedings were made as short as possible. The invitations issued numbered 150, being restricted to that figure on account of the want of space in the meter-house, where luncheon was to be served later. The event was a municipal one, for which reason the company was selected from the local communities, and consisted largely of representative men. It was found to be impossible, on account of the same conditions, to invite many. Of gas managers only two were asked to be present—Mr. W. Foulis, of Glasgow, and Mr. A. Yuill, of Dundee. The former was prevented from attending by the state of his health; and thus Mr. Yuill was the only representative of the body of gas managers.

The company assembled in front of the exhauster-house. On the arrival of Mrs. Steel, she was received by Provost Mackie, and was presented by Miss Esmé Herring, the daughter of the Engineer, with a handsome bouquet of orchid blooms. Mrs. Herring presented Mrs. Mackie with a bouquet of lily-of-the-valley and carnation blossom. Ascending the staircase, Provost Mackie, addressing the company on the ground, expressed regret at the absence of Lord Provost Steel, and asked them to accord Mrs. Steel a most hearty welcome. On behalf of the Commissioners, he presented her with a gold key, with which to unlock the door of the exhauster-house. This Mrs. Steel did, under the guidance of Mr. Herring. She then unfastened a cord which allowed a veil in front of the memorial tablet at one side of the staircase to drop. Mrs. Mackie similarly unveiled the tablet on the other side of the staircase. Thus the works were opened, and the company at once went inside, to escape the inclemency of the weather. A very short time was spent in the retort-house; but in the walk through opportunity was afforded to observe that everything was in spick-and-span condition, and officials in charge of the house assured visitors that the plant was working without a hitch.

Provost Mackie presided at the luncheon, and had, as croupiers, Sir Andrew M'Donald, Bailies Gibson and Bryson, and Mr. D. Purves. The interior of the meter-house was decorated with flags and foliaged plants.

The Chairman gave the toast of "The King," and on its being duly honoured, he proceeded to deliver the address he had intended to give at the opening ceremony. He said he did not mean to refer in detail to the great undertaking they had just inaugurated, because Mr. Herring, their able Engineer, would have an opportunity of speaking during the afternoon. Suffice it to say that the works were started in 1898, and the manufacture of gas was commenced four years later. He thought that this was highly creditable to Mr. Herring, who, he might tell them, had prepared all the plans for these great works. They lived in an age of vast undertakings, at the public expense, for the public weal. These undertakings imposed upon them fresh burdens, and he hoped they enriched them with fresh benefits. How far the modern tendency to what had been called Municipal Socialism might lead them, no one could prophecy; but in one direction they had ventured to go far beyond what their forefathers would have thought prudent or desirable—and the end was certainly not yet. At any rate, it was accepted as a truism that whatever was indispensable for the well-being of the community should be provided out of funds supplied by the community. In that form, the principle might be regarded as a perfectly safe one. But he was afraid they were rapidly extending it from things indispensable to things desirable; and as modern science widened their horizon, they were coming to regard many things as essential which past generations would have looked upon as unnecessary and extravagant. While there was thus room for criticism of some of the schemes which made a call upon the public purse, it would be conceded on all hands that the suitable lighting of their thoroughfares was a great public benefit which could not be neglected; and owing to the increased demand, notwithstanding the competition of the electric light, the Gas Commissioners had been compelled to make great additions to their working plant, in the shape of the huge works they had seen that day. These had been erected with every regard to modern requirements; and it was hoped they would prove of great public service, and would be fully equal to the requirements of the adjoining communities for many years to come. He trusted, at the same time, that they would give to the people an excellent return for the expenditure their erection had involved.

Mr. J. D. Millar, Advocate, proposed "The Corporations of Edinburgh and Leith." The two Corporations, he said, acted together in the supply of gas and water. They were amalgamated as regarded these subjects, and they worked together with the greatest amount of success and satisfaction to all concerned. There was one feature of the gas undertaking which was remarkable. That was that they had finished their work within the estimates; and they had also the satisfaction that there was no noticeable additional burden to be placed upon the shoulders of the ratepayers.

Bailie Telfer acknowledged the toast on behalf of the Corporation of Edinburgh, and Bailie Craig on behalf of the Corporation of Leith.

Mr. John Cowan, Master of the Merchant Company of Edinburgh, proposed "The Gas Undertaking." A gentleman from London, he said, who was of European fame in gas matters, was visiting him, and told him that there were two large gas undertakings on the Continent of Europe which were out of sight beyond anything to be found on the Continent. They obtained permission to visit the Granton Gas-Works, and on returning to Edinburgh, his friend told him that he had seen all the important gas-works in Europe, and a great many of the principal ones in America, and he could state, without fear of any contradiction, that the works he had shown him that day were the finest gas-works to be found in Europe. What one admired was the courage of the Gas Commissioners in going on with their great undertaking. But courage was not all; they had courage allied to energy and wisdom. There had been very great difficulties to contend with; but the Gas Commissioners had looked the difficulties in the face, and had been able to overcome them. The result, as they had seen, was really very splendid indeed. The Commissioners were prepared to produce gas at the very lowest possible price; but on comparing their town with others, he was afraid that their gas-lamps were not a credit to them, and unless the Corporation were prepared to face their work with courage, the courage which had been expended there would be to a large extent lost. He had great pleasure in coupling with the toast the name of Mr. Herring; and he thought that he echoed the thoughts of everyone when he said that, without the skilful management of Mr. Herring, this great undertaking would not have arrived at its present perfect position. In the planning and the building of the works, Mr. Herring had made for himself a name that would go down for a long time, and would cause him to be looked up to as one of the chief men in gas making.

Mr. Herring, in acknowledgment, said he rose with gratification, and yet with humility. He felt that he had been given, as a comparatively young man, a unique opportunity, on his coming to Edinburgh a stranger, and, he might say, in a strange land. He would not use the couplet which was often attached to that expression. As a matter of fact, they accorded him the greatest honour that man could accord to man—that was, they had confidence in him. He pointed out to them the situation in which the supply of gas stood; and he did feel that there was a very large measure of credit due to the Commissioners for tackling the question in the way they did, and facing the enormous financial obligations which he suggested were imperative in the interests of the gas supply of Edinburgh and Leith. That, he had since learned, they did in all important questions they grappled

with. They did not hesitate at all, but went right to the very spot. Their scheme was carried; and they were there that day celebrating its consummation. So far as the prosperity of the gas undertaking was concerned, a good deal would depend upon the policy which the Gas Commissioners might adopt in the future. Formerly, the gas supply was a monopoly. The electric light came forward; and for the first time in its existence of about eighty years, the gas supply was threatened with a competitor. The old bones shook and trembled in many places; but the situation was faced, and faced boldly. The great feature, he thought, of the future, in regard to gas supply, was to treat it more as a commercial undertaking than as a monopoly. In the old days, they thought it quite sufficient to deliver the gas at the consumers' meters, and leave them to do the rest. The consequence was dissatisfaction. Consumers were not taught; they were not shown how to obtain the best results. And even to-day there was not more than one-third of the lighting value derived from the gas which could be derived, if it were used in a reasonably scientific manner. This was one of the problems which the Gas Commissioners must face. They were now in a position to offer gas in any quantity. What they must do in future was to teach consumers how to use it. The only way to do so was not merely to be satisfied with the gas as it passed the meter, but to see it right through to the burner. They must see that consumers had suitable burners; and they must see that they kept them in a proper state, so that the greatest efficiency would be got from the gas. To do this, he was of opinion that the Commissioners should undertake the supply of every possible appliance for lighting, heating, and cooking. Whatever the "trade" might say in regard to their going into the business of supplying burners and appliances, he thought they would find that an impetus would be given to the demand for modern and improved appliances, which would ultimately redound to their benefit, as well as to the credit of the Gas Commissioners. So far as the new works were concerned, he was glad to say that they were already an assured success. They had been working about four months, and they had in their pocket £15,000 of clear profit, as the result of working there, as compared with the old works. He had no doubt that when their financial year closed there would be such a satisfactory statement as would warrant the Commissioners granting to consumers another substantial reduction in the price of gas. The net result of this was that the gas consumers of Edinburgh and Leith and of the surrounding districts had got a brand-new gas-works at practically no cost to themselves; for the economies they could bring about in the new works would be sufficient, not only to pay interest and sinking fund charges on the capital outlay, but also to allow of two or three coppers being taken off the price of gas. They proposed, he might say, shutting down the works about the end of April, for what might be termed a spring cleaning, occupying about a month or six weeks in overhauling the machinery and adjusting every little imperfection which might have shown itself in the course of the winter. After that, they would commence again and go on for ever. He would like to express his thanks to the staff, who had so ably and loyally supported him during the past years of stress in connection with the gas undertaking. They had all had to take their share of the extra work that was thrown on them; and they had responded most loyally. He was quite sure no public body could have a better class of men to work for them, and he thought it only fair to record his thanks to them for the services they had rendered to the Commissioners and to the public during the past three or four years.

The CHAIRMAN said that, in the erection of the new works, there had been involved an enormous amount of detail, which had called for continual attention and continual consideration. Now that the labour connected with the work was, so far, over, the Commissioners wished to mark their appreciation of the excellent services which had been rendered in connection wtth the construction of the new works by one who had devoted himself with ungrudging energy and zeal to the work. He need not refer to the great services rendered to the Commissioners by the late Bailie Kinloch Anderson, who for many years was Convener of the Works Committee. His work was taken up, after his health had broken down, by Councillor Purves. Time would fail him to recount to them one tithe of what had been done by Mr. Purves in his unwearied efforts to make the works above criticism and beyond reproach. He thought that such instances of public-spirited zeal and attention called for some special recognition on the part of those entrusted with the management of public affairs. The Gas Commissioners wished to give tangible expression to their feelings of gratitude to Mr. Purves, by presenting him with the gold snuff-box which he held in his hand, and which he had great pleasure in asking Mr. Purves to accept.

Mr. PURVES suitably acknowledged the gift, and proposed "Kindred Gas Undertakings."

Mr. A. YUILL (Dundee), in response, said he never saw such beautiful works as those Mr. Herring had erected for them. There were many beautiful sights in Edinburgh; but he thought that among his contemporaries, when they came to Edinburgh, the first sight they would ask to see would be the monument which Mr. Herring had made for the Corporations of Edinburgh and Leith, in the Granton Gas-Works. Since he came to Scotland, Mr. Herring had done noble work. He felt that now that they had got such beautiful works, and would be getting gas as cheaply as in any town, they must educate, not only themselves in the public lighting of the city, but they must also try to educate their consumers as to how the gas ought to be burned. With gas of 25-candle power, they could only take one candle per cubic foot, if improperly used; but they could get as high as 30 candles per cubic foot if consumed properly. If they had their streets properly lighted by gas—which was not the case now—they would certainly educate their people to put better fittings and better appliances in their own homes. In the neighbouring city of Glasgow, they were also engaged in the erection of huge gas-works. In these works there were to be horizontal retorts and mechanical charging arrangements; while at Edinburgh they had inclined retorts, also with mechanical appliances. When they had got the Glasgow works started, gas engineers would stand by and see with interest which was the more economical. He had no doubt himself; he pinned his faith to the works that Mr. Herring had given them that day. In economy of working, he believed they would surpass any.

The proceedings were brought to a close by the singing of "Auld Lang Syne."

Alteration of the Style of George Waller and Co.—For as many years as most men have been associated with the gas industry, the title of the firm of George Waller and Co. has been known to them. That title, Mr. George Waller informs us, has now been changed to G. Waller and Son, on the entrance into partnership of his son M. Bertram B. Waller, who has been associated with him in business for upwards of fifteen years. The new partner has made for himself many friends in the gas industry; and we heartily wish him and the firm under its new style a large measure of success.

"Chemical Technology."—We have received from Messrs. J. & A. Churchill the fourth volume of the above-named work. It deals with two subjects—electric lighting and photometry. The former, which occupies by far the larger portion of the contents, is treated by Mr. A. G. Cooke, M.A., Assoc.M.Inst.E.E., head of the Electrical Engineering and Physics Department of the Battersea Polytechnic, and the latter by Mr. W. J. Dibdin, F.I.C., F.C.S., under whose editorship the book has been produced. Fuller notice of the work of these gentlemen is reserved for a subsequent issue.

Artificial Lighting in the Nineteenth Century.—This was the subject of an address delivered by Mr. D. Macfie, of Messrs. James Milne and Son, Limited, to the members of the Edinburgh Architectural Association last Wednesday evening. The address was an exhaustive one, historically and scientifically, as are all Mr. Macfie's productions; and he was warmly complimented upon it. It is acknowledged that the lighting of interiors is one of the weakest spots in architectural training. It is therefore to be hoped that Mr. Macfie's descriptions may have gone home in quarters where they may be expected to produce some good fruit. We shall give in our next issue some extracts from this valuable paper.

Lord Rayleigh on Light.—At the Royal Institution last Saturday, Lord Rayleigh, the Fullerian Professor of Physics, and the Chief Gas Examiner for the Metropolis, delivered the first of a series of six lectures on "Light: Its Source and Nature." He began by describing the various sources of light apart from the natural illumination of the sun. The primary cause of most, if not all, artificial light lay, he said, in the heating of a body to a sufficiently high temperature. Among such cases might be included ordinary gaslight, limelight, and the electric light. A noteworthy example of the production of light was to be found in that which proceeded from heating the ash of a combustible body when its burning had been completed. This was the principle of the Welsbach light. In this connection, he showed a new form of inverted incandescent lamp, by which many of the defects of dark spaces and irregularities are overcome. Next Saturday, Lord Rayleigh will describe some new developments in electric lighting.

Transactions of the American Gaslight Association.—We have received Vol. XIX. of the "Proceedings" of the above-named Association. It contains the papers read at the thirtieth annual meeting held in New York last October, under the presidency of Mr. W. R. Beal (whose portrait is given as a frontispiece), with the discussions thereon, lists of officers and members, rules, &c. A large portion of the volume is occupied with the report of the Trustees of the Gas Educational Fund of the Association, in an appendix to which are reproduced the questions set to students in the several sections, and the answers by the Trustees. These are followed by an index to answers published in previous volumes, so that information on any subject may be readily looked up. Useful features of the book are a list of United States patents relating to gas issued from Oct. 1, 1901, to Oct. 1, 1902; an index to interesting articles in the current periodicals of the gas industry between those dates; and a list of new publications. The whole is produced under the editorship of the Secretary (Mr. A. E. Forstall). We must confess our inability to see the advantage of putting, as he has done, the text of the papers in an appendix, and the discussions thereon in the body of the book; but this is a detail upon which a difference of opinion is allowable.

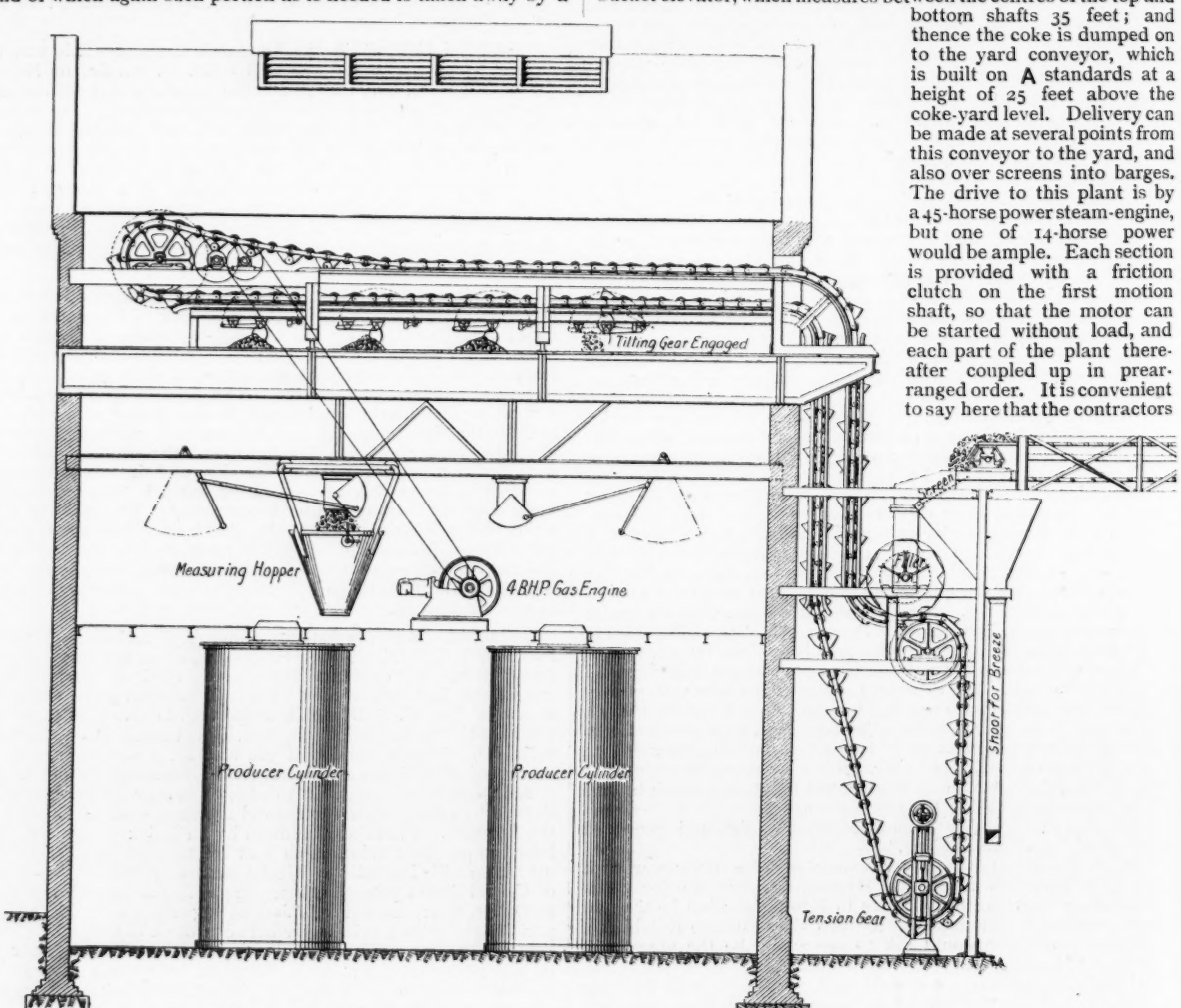
THE COKE PLANT AT THE SMETHWICK GAS-WORKS.

A Gravity Bucket Conveyor for Feeding Water-Gas Plant.

WHENEVER, in the pursuit of something new, duty calls to the Smethwick Gas-Works, a feeling of veneration always overtakes us, and must all occasional visitors who are intimately connected with gas engineering, and who know anything of the early history of gas lighting, of the doings of Murdoch, and of the other great engineering giants who laboured, created, and gave to the world from that neighbourhood many of the things which have revolutionized the conditions of the people. The limit of a single article does not give scope for full reference to these matters; but just for one moment let us stop. Approaching the gas-works, we see the works once occupied by James Watt, and in which the inventive genius of Murdoch was ever unfolding itself; we see the huge works of Messrs. Tangyes, in which is housed a museum containing relics reminiscent of the work of him whom all gas men of this country honour and respect. Entering the gas-works yard, and looking across the old purifiers, we see still standing the ancient gasholder in which Murdoch stored gas, and farther away the spot where still exists the house in which he once lived, and which he himself lighted with coal gas. The surroundings of the Smethwick Gas-Works are not pretty; but they attract, as round them cling memories of a great past. In saying this, let it not be imagined that in the Smethwick works there are not other features of interest. Our pages have before borne testimony to the contrary, and there are now further new ones.

Not far away on the site of the old works of James Watt, research declares that Murdoch constructed a conveyor for the transmission of small stampings; next door to-day in the gas-works are examples of the great developments, brought to the utmost pitch of perfection in utility, from that early, and maybe somewhat crude, form of conveyor for stampings. In the gas-works, we see the coal delivered and dumped into the coal-breaker, elevated to hoppers in the retort-house, carbonized, the spent charges carried from the house by a coke-conveyor, at the end of the house elevated to a distributing conveyor, from the end of which again such portion as is needed is taken away by a gravity-bucket conveyor to the coke-hoppers in the new carburetted water-gas house, then fed into the coke-measuring chambers, and finally into the water-gas generators. There we have a cycle of operations which takes in two complete gas-producing processes—one at one end of the works, and one at the other—without at any one part any handling of material, other than by mechanical means. This is the latest development of the system of conveying material in gas-works which would rejoice the heart of the most pronounced advocate of completeness of mechanical operation in gas-works. During an inspection of the plant last week, the Engineer of the works (Mr. Vincent Hughes) called attention with some pride to this completeness of the round of the methods under his charge in dealing with his coal and coke, and the last step in the completion of which round has been made from his p'ans—that is to say, the installation of the carburetted water-gas plant, and the provision of the gravity-bucket conveyor, with the other parts of the water-gas plant coke-feeding appliances, working in conjunction with the existing hot-coke conveying plant, which, by the way, has been in operation for about four years.

It will render the description more understandable if we first indicate generally the arrangement of the coke plant, and then deal with it in more detail. The retort-house (which is situated from its extreme end 366 feet from the water-gas plant) contains four beds of eight inclined retorts, and nine beds of 20 feet horizontals, with West's hand-drawing machinery. It is contemplated, when the time is opportune, to convert the whole of the house to inclines. This projected change accounts for the fact that there is only one hot-coke conveyor running through the house, to deal with the coke from the inclined retorts and from one side of the horizontals. The conveyor is about 170 feet long, and 15 inches wide, and the top of the trough is level with the drawing-floor. This conveyor, it may be mentioned, has the old-fashioned cast-iron troughs, which have been discarded in the new design of hot-coke carriers. At the end of the retort-house, delivery of the coke is made into an 18-inch double-chain tray-bucket elevator, which measures between the centres of the top and bottom shafts 35 feet; and thence the coke is dumped on to the yard conveyor, which is built on A standards at a height of 25 feet above the coke-yard level. Delivery can be made at several points from this conveyor to the yard, and also over screens into barges. The drive to this plant is by a 45-horse power steam-engine, but one of 14-horse power would be ample. Each section is provided with a friction clutch on the first motion shaft, so that the motor can be started without load, and each part of the plant thereafter coupled up in prearranged order. It is convenient to say here that the contractors

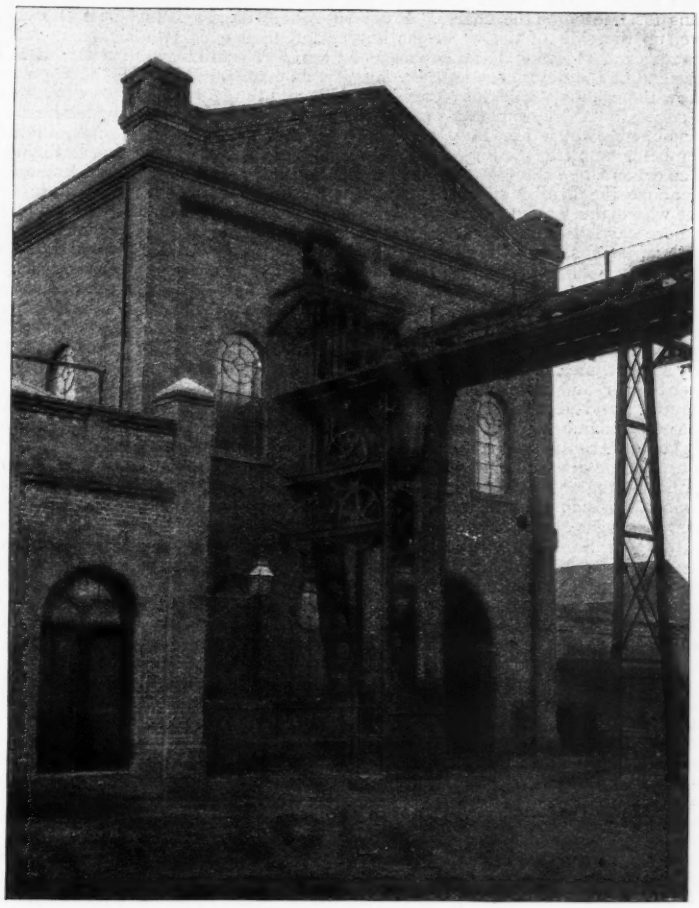


COMBINED GRAVITY BUCKET COKE ELEVATOR AND CONVEYOR AT SMETHWICK.

for the whole of the coke plant were the New Conveyor Company, Limited, of Smethwick; and this inspection gives us the opportunity of referring to improvements which they have effected in their conveyors since the first portion of the plant was installed here.

Having briefly described the hot-coke conveyor, we will proceed to the coke-feeding arrangements in connection with the water-gas plant. It is proposed to treat this in the following manner: First, to give a general description of the system, which includes the gravity bucket combined elevator and conveyor—the first, we believe, that has been adopted in a gas-works in this country. (Parenthetically, however, it may be stated that several have been put in at electric lighting stations—notably at Newport, Sheffield, Leeds, Manchester, Exeter, and at the Central Electric Supply Company's station at Grove Road, London.) Then an indication may be made of the chief sizes of the details, as it is believed that by doing this engineers will be enabled to follow the line of thought which brought this type of conveyor into existence; and the result will be that other situations equally adapted to the use of the gravity bucket system will be at once apparent.

Taking, then, this order of treatment, the coke on being dumped from the end of the yard conveyor falls down a screen shoot, which allows the dust to bye-pass to the ground level, and the large coke finds its way into a revolving filler. This filler is driven by the conveyor chain; and in shape it represents a circular drum 17 inches wide—the inlet being in the centre of one side, and the outlet successively through one of a number of pockets, the mouths of which dip into the buckets as the latter pass underneath the filler. Each bucket is thus carefully loaded without breakage of the coke. Reference to the general arrangement drawing will show that, after being filled, the buckets travel round cant wheels, and then descend to within a few inches of the ground level. At first sight, it would appear that this bottom loop of the chains is unnecessary. But as every coke plant, no matter how well designed, on occasion, and generally when least expected, may be stopped for a day or two on account either of accident or ordinary wear, the buckets have been brought near the ground, so that, when the old portion of the plant is stopped, or when coal gas plant may not be at work, coke can be wheeled from the adjacent stack, and shovelled into the buckets. This bottom loop



THE GRAVITY BUCKET ELEVATOR AND CONVEYOR FOR FEEDING THE WATER-GAS PLANT.

At the head of the Breeze-Shoot in front is the point at which the Yard Coke-Conveyor delivers Coke to the Filler, which in turn transfers its Load to the Buckets.

THE CARBURETTED WATER-GAS PLANT BUILDINGS.

The Boiler-House, the Machinery-Room, and the Generator-House, with a more distant view of the Coke-Feeding Plant.

passes round wheels which act as guides, and also provide the means for tightening the chains. From the wheel the buckets travel up the side of the water-gas house, and then over two hoppers, each of which has a capacity of 5 tons. We will leave to the end of the description of the conveyor, an explanation as to how the coke is stored, measured, and delivered to the water-gas generators. The buckets can be tipped at any point over the hoppers, which are thus completely filled automatically. After being emptied, the buckets travel round end wheels, which act as drivers, and the idle strand is carried on rails, parallel to and above the loaded strand, to the end of the house at the point where the loaded buckets enter (see photographs). They are here carried round tracks, and finally descend under the filler again—thus completing the cycle.

Although two hoppers have been provided in the generator house, only one is required at present; the second having been fixed in anticipation of the installation of the second set of carburetted water-gas plant. However, underneath the hoppers are fixed channel rails, in the body of which work wheels, which carry a 7 cwt. measuring chamber. This can take the coke from either hopper, and travel over either the present or the prospective generator; and on the special bottom door being opened, the contents of the chamber are discharged direct to the producer. The only labour necessary—apart from the starting of the engine, and the usual time given to oiling the working parts—is in the opening and closing of the doors, and the discharging of the measuring chamber. We do not remember having seen a single instance in which water-gas generators are charged more expeditiously than are these at Smethwick; the time occupied in charging the generator being $\frac{3}{4}$ minute only. In the last paragraph but one of this article, a little more attention is devoted to the hopper-discharging arrangements.

The foregoing indicates the manner in which the old and new plants were designed, so that the latter would work in with the former; and now, as previously promised, some attention may be given to the details—taking the plants separately, in the order in which they were installed. The hot-coke conveyor forms a most important subject for consideration in every gas-works; and, bearing in mind that the conveyor now under notice was the first to be erected on Little's patent carrying principle, it will be only fair to presently describe in what direction improvements have been made on the numerous plants that have since been put in at various works. The original idea of having cast-iron troughs is embodied in the Smethwick conveyor; and it is interesting to learn that the only other works where this style has been retained in the carrier conveyor is at Tottenham. In form, it represents a trough with parallel sides for a height of about 3 inches; and above this the metal is splayed out, so that the top edges show an increased width over the bottom sides—the alteration being from 15 inches to 18 inches. In the trough travels the carrier, formed of $\frac{1}{4}$-inch steel plates, $14\frac{3}{4}$ inches wide by $13\frac{1}{2}$ inches long, connected to a 12-inch pitch single chain $3\frac{1}{2}$ inches wide, in such a manner that $1\frac{1}{4}$ inches of lap is made. This keeps the joints tight, and prevents the coke from getting to the chain. In every second link, there is a roller working on a $\frac{3}{4}$-inch pin, which rolls along the bottom of the trough, and supports the steel belt. The chain works over 2 feet diameter steel drums, which are keyed on massive steel shafts, operating in long brass-bushed bearings attached to the conveyor framework. This framework consists of $2\frac{1}{2}$-inch vertical angle-irons, attached to the flanges of the trough, so as to carry the bearings, in which work the spindles, to each of which are attached two 6-inch diameter cast-iron rollers, supporting the return strand of the carrier as it travels along in the subway.

In conformity with the plan of this article, it will be convenient at this point, while the details of the Smethwick hot-coke conveyor are fresh in mind, to note the progressive improvements since made in the various plants of this type laid down by the New Conveyor Company. The steel trough first found favour at Brighton, where Mr. Joseph Cash put in among other plant four hot-coke conveyors. The troughs are built with sides made with two 9-inch splay-topped channel bars, to the bottom flange of which is riveted a $\frac{3}{8}$-inch plate. At Brighton, also for the first time, the carrier plates were increased to 18 inches wide; and simultaneously the method of supporting the loaded strand was improved by the adoption of a bracket provided with a pin and cast-iron roller, which was attached on each side of the chain to every third carrier plate. These took the place of the small rollers in the body of the chain. What at present appears to be the culminating point has, however, been reached at Birmingham, where the steel troughs are made 24 inches wide, and wearing strips are secured to the bottom and sides of the trough to form paths for the rollers and skids for the plates respectively. A further important change is made on the chains both in material and design. In the former, from malleable cast to stamped steel, and in the latter from solid to bushed links. It will be apparent that the parts most likely to wear are the pins and rollers attached to the travelling plates; and to make the life of these more in proportion to the rest of the conveyor, manganese steel has been tried—it having been found by experience at the De Beers mines that, for resisting wear on driving-chains in bad situations, it has no equal. It occurs to us that the cost of these pins and rollers must be a considerable item in the making of the conveyors.

However, with this summary of improvements on the Smethwick hot-coke conveyor, the elevator at the end of the retort-house next claims consideration. This is placed at right angles to the carrier; and it is set at an angle so as to deliver to the yard conveyor, at a height of 25 feet above the coke-yard level. Mr. Hughes, who is keen on improvement in every part of the works, very frankly said that this was the only part of the coke plant which he would like to see altered. At first, the reason for this was not quite obvious, as we remember having heard engineers speak highly of this form of tray bucket elevator for lifting coke; but on inspecting the working of the addition to the coke plant at Smethwick—the combined elevator and conveyor with the swinging buckets—no other than endorsement could be given to the opinion that Mr. Hughes expressed, that in the near future engineers meditating the adoption of elevating and distributing apparatus for coke ought not to neglect the gravity-bucket system in their consideration of the various plans submitted to them.

But, to pass on. The coke received from the tray-bucket elevator is carried on to a 24-inch wide conveyor, the travelling portion of which comprises steel plates $\frac{5}{16}$ in. thick by $13\frac{1}{2}$ in. long, overlapping each other $1\frac{1}{4}$ inches. These plates are mounted on two chains, 12-inch pitch, which work round end wheels 2 feet in diameter, being carried on the top and bottom by rollers, cast on spindles, which revolve in bearings attached to the framework. This frame consists of four rows of 3-inch angle-irons, with Pritchard patent side rollers attached at frequent intervals. The angles are securely braced in the usual manner, to form a lattice girder, which is, in turn, carried by standards built of 6 in. by $2\frac{1}{2}$ in. channels, $2\frac{1}{2}$-inch angles, and 2 inch lattice bars, bolted to concrete bases. From the conveyor, the coke can be sent over jigging screens to barges, down adjustable shoots to the yard, or at the end into the gravity-bucket conveyor.

This brings us to the details of this innovation in gas-works coke plant. The shoot between the two conveyors has a perforated bottom plate, which allows the dust to pass through into a spout which discharges into a barrow, while the coke passing over is sent into the special filler. Here reference should be made to the drawing, in order that the following description may be perfectly clear. Our first effort will be to show how the pivoted buckets are filled without any spilling and in such a gentle manner that breakage of the coke appears to be impossible. The contrivance used is not only new to gas-works, but almost unique as applied to a conveyor, having been tried only at Newport (Mon.) for the loading of coal at the tramways electric power station. We cannot better describe it than by likening it to a big drum, made of steel, mounted on a 3-inch shaft, with an 18-inch hole cut into one side, into which is inserted the filling shoot, so that any material introduced into the inside of the drum must find its way out at one of several holes in the periphery—egress being possible only at one of these holes at a time. Each hole terminates in a funnel mouth, which forms part of the revolving filler, and the one through which the coke is allowed to pass is closed by a bucket, which takes its recognized quantity only, and in passing on brings the next bucket under the succeeding outlet of the filler before any more coke can escape. The filler is driven by the conveyor chains, so that any variation in the speed of the conveyor is also imparted to the filler. In the case of this example at Smethwick, the filler is fixed; but in situations where the feed is from different points, it can be made to travel to any required position.

In regard to the gravity-bucket conveyor itself, special attention has been given to the working parts, as will be seen from the following description. The endless chains, of which there are two, are kept at the required distance apart by 1-inch round bars, passing through both links on each chain; the pitch of the bars being 2 feet, so that, with a 12-inch pitch chain, one occurs in every second link. Each chain consists of two bars in every foot; the joint pins being 1 inch in diameter, and they pass through bushes let into the inside links so as to form distance-pieces. In addition to the joint pins, there are in each link a 1-inch pin and a distance bush to act as drivers for the filler chain wheel, and another 1-inch pin, on which revolves the 5-inch diameter ($2\frac{1}{4}$-inch face) cast-iron roller, the eye of which is recessed in the centre to form an oil-well, which is filled with absorbent packing to hold the oil introduced through a diagonally drilled hole. The 1-inch pins passing through the distance bush project on the inside of the chains, and are there increased to $1\frac{1}{4}$ inches diameter; the object being to carry the buckets which swivel on the pins. These buckets (which, in their widest parts, are 17 in. by 17 in.) are made seamless, and have bolted to each side a bracket, the top part of which is bored to fit the pins in the chain. On the bottom part is fixed a roller, which comes into play when the buckets have to be tipped. While the chains work horizontally, vertically, and diagonally (as will be seen by the photographs), the buckets retain one position—that is, with their mouths upwards, until they reach a tipper. The tippers can be placed on any horizontal or diagonal part of the conveyor run. In the present instance, they are, of course, over the coke storage hoppers, so as to allow these to be completely filled. The principle on which the tippers work is the forming of an inclined track, which engages the anti-friction rollers on the bottom of the buckets; and as the pins in the chain form an axis near the mouth of the bucket, the bottom is tilted up as the chain travels along—thus dumping the coke into the hoppers. The tracks on which the chain rollers run consist of light rails, which, at Smethwick, are also made to act as curves at

the corners for altering the direction of the travel; but where possible (we are informed) it is advisable to use wheels for this purpose, as a saving in power is thus effected.

The example under notice of this gravity-bucket (or "noiseless" it might be termed) conveyor has to contend with perhaps about the most adverse conditions that could be found, inasmuch as there are no less than seven curves in a total length of about 200 feet; and when it is stated that Mr. Hughes speaks quite enthusiastically of its reliability and exactness, no better testimony could be wished by the makers. Its first cost, we are told, is not excessive; and a further commendable benefit lies in the small amount of power required to drive the conveyor. At Smethwick a 4 B.H.P. Tangye gas-engine more than suffices for the work—in fact, it is calculated that 1-horse power per 100 feet horizontal run of conveyor is ample. (The conveyor, it may be parenthetically mentioned, has a capacity of 30 tons per hour when travelling at the rate of twenty buckets per minute, which represents a speed of 40 feet per minute on the chains.) The engine is bolted to the charging-floor, and is provided with a house in order to keep out the dust. A 7-inch pulley on the crank-shaft allows a connection to the fast-and-loose pulleys on the first countershaft by a 3-inch single belt; and the motion from this shaft is transmitted to the end shaft of the conveyor through two sets of reducing spur gear, which gives a speed of about four revolutions per minute to the conveyor driving-wheels, which are 4 feet in diameter, and provided with steel teeth, made renewable by being cottered into the rim of the wheel.

Before leaving the new plant, there are just one or two unique points in the construction of the outlets from the hoppers, and in the measuring-hopper itself, which deserve notice. On the bottom of each hopper, there is a square box, with two pins bolted thereto. On these pins swings a cut-off door, which, in its normal position, closes the outlet from the hopper. To these radial doors are coupled rods, ending in a jaw, into which fits one end of a lever; the opposite end behind the fulcrum reaching to within a few feet of the generator charging-stage. On the measuring-hopper being brought under either of the storage tanks, the lever is pulled and the door opens—almost, it may be said, without any exertion on the part of the operator. In the event of a large piece of coke such as is made in the inclined retorts getting across the gap between the edge of the door and the side of the tank mouth, it is simply knocked out of the way by the swing of the door; plenty of clearance being still allowable between the door and the hopper even when the outlet is effectually stopped. The measuring-hopper (as before mentioned) is designed to measure a charge of 7 cwt. to the generator. This measurer represents a funnel, and the spout is slightly less in diameter than the generator inlet, so that, on the one being pulled over the other, the contents of the feeder are discharged when the bottom door is released. This is done by the attendant knocking away a catch, which is pressed upon by a tooth wheel keyed on a spindle running across the top of the measurer. In the middle of this spindle is a wheel about 12 inches in diameter, to which is attached a $\frac{3}{8}$-inch link chain; the other end being bolted to the conical door, which is raised or lowered according to whether the measurer is to be filled or discharged. Mr. Hughes calculates that the plant saves him at least one man's work on the carburetted water-gas apparatus. Taking the coke plant as a whole, it is quite capable of coping with at least double the amount of coke that it has to handle at present.

This article has already run to such a length, that it will be preferable to treat of the new carburetted water-gas plant (which has been erected by the Economical Gas Apparatus Construction Company, Limited) in an independent article. But it may be said that this new system of feeding the generators with coke has taken our fancy. The plant is simple; it is plain that it will stand hard wear; and its working cost is low. Mr. Hughes must be heartily congratulated upon his new possessions.

THE FISCHER AIR-GAS SYSTEM.

Following closely upon the heels of the description of the "Petrogene" air-gas plant which was given in the "Journal" a few weeks ago, we have had our attention drawn to another carburetting plant designed to serve a somewhat similar purpose. In this case, however, the gas is, for preference, generated by means of the carburetting of atmospheric air with heavy tar oils—especially benzol—in a refined or unrefined state, without any further admixture whatsoever, though trials made with petroleum have also given good results. The invention, which is named after the patentee, is owned by the Fischer Light Syndicate, of Grosse Bruedergasse, 22, II., Dresden, and is fully protected both in England and Germany. The gas generated is suitable not only for lighting, but also for cooking, heating, and motive power purposes; and it can be used for very large as well as for very small installations. Though, perhaps, with all these air-gas machines the question of convenience must take a prominent place, this is in the present case not by any means the chief advantage; for the Fischer light is claimed to be the cheapest illuminating medium known at the present time, while it is said that no other gas can compete with it in this respect for fuel and power purposes.

The Syndicate are represented in England by Mr. Oskar Wentz, of 67, Clarendon Road, W., who has invited us to inspect a working model of the invention. Though the machine is large when regarded from the point of view of a model, it is very small when looked at as an actual gas-making machine; and yet it supplies several incandescent mantles with the wherewithal to emit a brilliant white light of unvarying steadiness. Indeed, the apparatus is of so compact a form, that for the supply of (say) 25 lights it would not be necessary for it to be more than about $3\frac{1}{2}$ feet in height; while for a more extensive installation a machine of comparatively very little larger size is needed. As only a small provision of carburetting material is required for it, in most countries it would be unnecessary to obtain any special licence from the authorities. The cost of manufacturing the appliance is very moderate; and it would be possible to retail one suitable for a 50-light installation at from £30 to £35. Then, again, it requires no skilled attention—in fact, almost the only attention of any kind needed, is for about half a minute just at the start, when the motor has to be turned two or three times by hand. The gas, which is immediately generated by this movement, afterwards automatically continues the motion of the motor. The only other consideration is that of wear and tear; and taking into account the comparative simplicity of the arrangement, this can hardly be a serious item.

The English patent specification—No. 9609 of 1900—states that the arrangement consists (as shown in fig. 1) of a combination of an improved carburettor A with pressure-reducing device, an air reservoir or accumulator D, and a hot-air or other

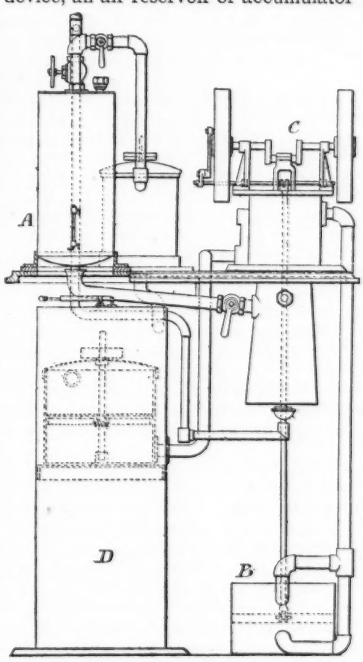


Fig 1

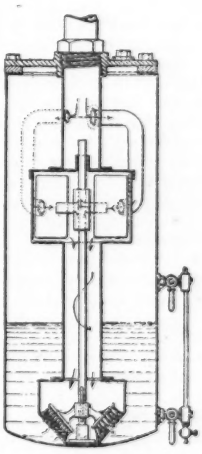


Fig. 2.

suitable motor C—the whole being connected together in such a manner that when the demand for the air gas ceases or diminishes, its production automatically stops or diminishes in like degree. There is nothing special in the construction of motor employed; but a hot-air or explosion engine is preferred, as these can be most conveniently driven by the carburetted air produced by the apparatus. The motor drives a small blowing engine or air-pump B, which delivers air into a pressure-reducing device (arranged inside the air-reservoir), the object of which is to provide a supply of air to the reservoir at constant pressure. This pressure-reducing device consists of a vessel or box divided into two compartments by a horizontal partition. The top of the box is closed by a diaphragm of flexible material rigidly connected to a vertically moveable rod, on which is secured a valve closing a valve-seat in the partition between the upper and the lower chambers. The upper of the two chambers communicates with the interior of the reservoir; while the lower one is connected by a pipe with the blower or air-pump. When the pressure in the reservoir sinks below a certain point, the diaphragm collapses slightly inwards, opening the valve between the two partitions, and so permitting air to flow into the reservoir. To still further equalize the pressure of the carburetted air delivered for consumption, the air from the reservoir may, on its way to the carburettor, be passed through a second pressure-reducing appliance of similar construction. A valve opening to the external air, and loaded to any required degree, enables the consumption of the liquid hydrocarbon which is employed in the carburettor to be limited to the occasions on which the carburetted air is used, as when all the taps leading the gas to the points of consumption are turned off, the air blows off in the reservoir by means of the externally opening valve, and none of it passes through the hydrocarbon.

The carburettor (fig. 2) is provided with a level indicator, and is traversed by a tube which introduces the air, through finely perforated sheet iron or wire gauze, near the bottom of the containing vessel, to the carburetting fluid. This pipe is provided with a chamber, in which a turbine-wheel revolves in bearings. The portion of the pipe situated above this turbine is completely closed from below, while two or more tubes branch from it into the chamber. The lower end of the turbine-shaft carries a brush arrangement, which turns with the axle of the turbine; and, rubbing on the perforated iron or gauze surfaces, keeps the apertures clean and open. The current of air produced by the blower, which passes into the upper part of the pipe, is divided and carried on so as to operate the cleaning mechanism, during which process an equalization of any difference of pressure in the air tends to be effected. In the method of carrying out the invention illustrated in fig. 1, a hot-air motor is employed, as a portion of the gas made can be used for operating it. At the same time, the current of air produced by the blower can be partly requisitioned for cooling the motor, whereby both the preliminary heating and drying of the air before carburetting is effected, while a certain portion of the air heated by the motor can be led under the carburettor so as to warm it, and prevent it being too much cooled by the process of carburization. Beneath the motor is a burner supplied with gas produced by the apparatus; while the cylinder is surrounded by a jacket cooled by air from the blower, which afterwards passes, partly warmed, to the reservoir. As there is no excessive pressure, the motor works without danger. The flow of the liquid hydrocarbon from the storage tank (which can be placed at any distance) into the carburettor is effected automatically by means of a patented appliance, in such a manner that the carburettor always contains an equal quantity—that is, it is kept supplied with the liquid to the extent of about one-third of its capacity.

Not having been able, unfortunately, to see the invention applied to a regular gas-making installation, and to test its capabilities when employed on an ordinary working scale, we have been obliged to depend mainly on Mr. Wentz for a recital of the advantages it possesses. One point is that the liquid to the very last drop is turned into gas, so that neither in the carburettor nor in the piping does any deposit take place. All danger of explosion has been absolutely excluded, as is proved by the fact that the apparatus, after it had been working for a considerable time, was exposed to an open fire, without the gas being generated in the carburettor becoming ignited. The arrangement is such that the carburettor makes only so much gas as is actually wanted for use; and there is thus never any storage. Should the apparatus be working when no burner is lit, only so much gas is generated as is necessary for the operation of the hot-air motor; and if it is brought to a standstill, or if for any reason it stops of its own accord, the gas is consumed by the flame up to the last atom, so that the gas-cocks may remain open without the slightest danger.

It is claimed that an incandescent burner supplied with Fischer air gas gives three times as much light as a similar one using ordinary coal gas, and at a much less cost. For an incandescent burner giving an illuminating power of 40 candles, the cost, at the present price of refined benzol in Germany (24 marks per 100 kilos), is stated to be $\frac{1}{8}$d. per hour; for a burner giving a light of 110 candles, $\frac{7}{16}$d.; for a 200-candle burner, $\frac{1}{4}$d.; and for a 400-candle burner, $\frac{7}{16}$d. The same gas can also be used for heating and power purposes; and it shows in closed cylinders (in gas-motors) a power of expansion from 30 to 40 per cent. greater than is obtainable with ordinary gas. For the lighting of large areas, it is only necessary to place carburettors in the various localities to be served, and to convey air thereto through pipes from a central station. These pipes can be placed quite close to the surface, or even above ground, thus, of course, considerably reducing the cost of an installation.

Having said so much, we must leave this invention to fight for supremacy, or at all events for a prominent position, with the other air-carburetting machines in the field. Without doubt there is an opening for such an arrangement of the kind as can offer the greatest advantages; and the prize must be to the best. It is only necessary to remark that Mr. Wentz will gladly show his working model to any of our readers who may be moved by this description to inquire further into the merits of the Fischer air-gas system.

The formal installation of Dr. A. C. Humphreys as President of the Stevens Institute of Technology, Hoboken, in succession to the late Professor Henry Morton, took place on the 5th ult., in the Carnegie Laboratory of Engineering, adjoining the main buildings of the Institute. The audience was a distinguished one, and included Mr. Andrew Carnegie, who congratulated the Institute on the choice they had made, and expressed the opinion that if the deceased Professor could have had anything to say about the appointment, the selection would have had his entire approval. In accepting the honour conferred upon him, the new President made a characteristic speech which was full of interesting points. In the evening, the Alumni Association of the Institute gave a banquet to him, at which more than 400 were present, among whom were several representative members of the gas profession. The proceedings were of a very hearty character. We cordially congratulate Dr. Humphreys.

TECHNICAL RECORD.

INSTITUTION OF GAS ENGINEERS.

The Statutory General Meeting of the Institution was held last Thursday, at the Institution of Mechanical Engineers, Storey's Gate, S.W.—the PRESIDENT (Mr. Andrew Dougall, of Tunbridge Wells) in the chair. All told, there were not more than three dozen members present; the notice convening the meeting having announced that the proceedings would be merely formal.

The SECRETARY (Mr. Walter T. Dunn) having read the notice calling the meeting,

The PRESIDENT said he was very sorry it was requisite under the Act of Parliament to call the members together for such a formal matter as they had to discharge that day; but it was necessary to have a meeting of this kind, and to simply report to the members that the new Institution of Gas Engineers had been incorporated and registered. They had present the certificate of incorporation, which he did not suppose the members would want him to read. The Council had not yet received all the applications for membership; there were a number of foreign members who had not yet made application. But he thought the number would come to something like, in round figures, 700. The Council hoped that this number would greatly increase in future. He was sure the new Institution would have a very successful career, and that it would do much to advance the industry which the members represented, and which they served, and which in its turn served them. He did not know that it was necessary for him to say any more, as all he had to do was simply to make the report to the members that the incorporation and registration had been carried out.

After a pause, the PRESIDENT added that the Solicitor informed him that this concluded the business of the meeting. It was a very formal thing. He also mentioned that a meeting of the contributors to the Benevolent Fund would be held at three o'clock. If there were any present who did not contribute to that fund, he asked them to join that afternoon. They would be heartily welcomed to the meeting.

THE FUTURE OF THE BENEVOLENT FUND.

Subsequently, a Meeting of the Contributors to the Benevolent Fund was accordingly held; the PRESIDENT again occupying the chair.

The SECRETARY read the notice convening the meeting.

The PRESIDENT said the notice that had been read announced to them the business for the meeting—that was, to take into consideration the necessary alterations to the Benevolent Fund rules owing to the amalgamation of the Institute and Institution. The Solicitor had prepared resolutions in order to carry the necessary alterations into effect. He would ask him to read them, and explain what was needful to be done in the matter.

The SOLICITOR (Mr. H. A. Hood) said those present would probably all remember that the Benevolent Fund of the Gas Institute was not an asset of the Institute which had to be handed over to the new Institution. Therefore, it must be dealt with separately; and, of course, the point at once arose whether members of the new Institution who were not members of the old Institute could participate in the benefits of the fund. It was perfectly obvious, he thought, that they could not. Therefore, there was a fund in the hands of Trustees in which only certain members of the new Institution would be able to participate. This seemed to him, and he thought to the President also, a very undesirable position. There were two alternatives before them—one was that the whole body of contributors to this excellent fund should agree that the members of every class of the new Institution, as well as those members who belonged to the old Institute, but who were not members of this Institution, should all be allowed to have the benefit of the fund; and in that case, they would have to pass a resolution enabling the Committee to make such alterations in the rules as were necessary to give effect to that idea. But he was afraid, from a strictly legal point of view, it would be improper for them, and impossible for them, to give effect to this unless the contributors were unanimous. There might be some contributor who objected to anybody who was not a member of the old Institute—who, for instance, was a member of the old Institution—participating in a fund which he was never entitled to have any share in when the fund was first started. If this idea struck many people, then he thought that what would have to be done would be to have two funds—practically an "A" fund and a "B" fund; the "A" fund being the existing stocks standing in the names of the Trustees, and probably it would be found that they would have no further contributors to those stocks—no further donations, and no further subscriptions. Future subscriptions would probably be invited, and probably contributors would wish to give, in order to establish a considerable sum of money, entirely to the new, or "B," fund, in which members or their families of all classes of the new Institution would participate. In order to carry out either scheme, he was going to ask the members to pass a resolution in an alternative form. When those present

had been kind enough to pass this, the Committee would draft a form of circular to be sent out to all the contributors; and it was hoped they would be unanimous. If they were, the fund "A" would be open to everybody. Certain alterations in the rules would then be necessary; and he would read the principal of these. This was all the contributors would have to do. The same Trustees would be perfectly able to maintain their present position; and therefore a little expense would be saved that way. If, however, a considerable number—an appreciable number—of contributors were to say, "We don't want to have anything to do with any interference with that fund," they would have the old fund "A" with its proper rules, and would not require any alteration. Then new rules would have to be made for fund "B," which, he suggested, should be drawn by the Committee and presented to the Council for confirmation at some future meeting. The second rule for the present Benevolent Fund was: "The object of the Benevolent Fund is to afford assistance to necessitous members of the Incorporated Gas Institute and their families, and to the families of deceased members, or to anyone, or to the family of anyone, who may have been a member, whether such member shall have been a contributor to the Benevolent Fund or not." Obviously, if they carried out scheme "A," the only alterations that would be required would be something of this kind: "The object of the Benevolent Fund is for the assistance of necessitous members of all classes formerly, or at any time, belonging to the Gas Institute incorporated in 1890, or the Institution of Gas Engineers incorporated in 1902, or to anyone, or to the family of anyone, who might have been such member, whether he has been a contributor to the Benevolent Fund or not." There would be some verbal and clerical alterations besides. If this was quite clear to everybody, he would read the resolutions. The first one was—

That this meeting of contributors to the Benevolent Fund of the Gas Institute incorporated in 1890 approves of the following alternative scheme being submitted to the general body of such contributors:

(A) That the members of all classes of the old Gas Institute and the new Institution, and their respective families, be admitted to participate in the benefits to be derived in respect of the funds already subscribed, and now belonging exclusively to the Committee of the old Institute, and of all future subscriptions, and that the fund be described in future as the Benevolent Fund of the Institution of Gas Engineers.

Then the alternative scheme is—

(B) That the existing fund be called by the present name, and be applied solely in accordance with the existing rules, and that a new fund, to be called the Benevolent Fund of the Institution of Gas Engineers, be established, to which all future subscriptions and donations, unless otherwise expressly given, shall be credited, and that members of all classes of such Institution and their families only shall participate in the benefits thereof

The second resolution is—

That the Committee of the existing Benevolent Fund be authorized to make any alterations they may think necessary in the existing rules, and any new rules, and to take all other steps for the purpose of giving effect to resolution "A" if the contributors are practically unanimous in favour of such resolution, or to resolution "B," subject, in case resolution "A" is adopted, to the confirmation of a subsequent meeting of the contributors, and in case resolution "B" is adopted to the confirmation of the Council of the Institution.

These were the two resolutions; and if the members present passed one, they would naturally pass the other.

Mr. R. G. SHADBOLT (Grantham) said he took it that, in the event of there being no material objection to resolution "A," that would be the one adopted.

The PRESIDENT: Yes, that is so.

Mr. SHADBOLT: Then, in the event of there being a great deal of objection, you would adopt "B?"

The SOLICITOR: I do not think that it would be fair to treat the present fund as an amalgamation fund if there was much opposition.

Mr. OCTAVIUS THOMAS (Pentre) proposed that resolution "A" should be adopted.

The SOLICITOR: We have to communicate with the general body of contributors by circular. If any gentleman will express a strong feeling in favour of the amalgamation scheme, probably it will carry weight with the other members.

Mr. ROBERT PORTER (Elland): Would it not be a mistake to put the alternative scheme before the members until they have expressed an opinion on scheme "A?"

The PRESIDENT: If we do not put the alternative scheme, we shall have to call another meeting.

Mr. CHARLES WOOD (Bradford): Could it not be left with the Committee to put before the contributors scheme "A;" and then, if they do not get a sufficient amount of support for it, they could put the alternative one.

The SOLICITOR: In the circular, we shall only put the "A" scheme.

Mr. SHADBOLT: The resolution, I take it, will empower the Committee to send out scheme "A;" and if there is any material objection, then they have the alternative scheme to fall back upon.

The PRESIDENT: We only want the power now, or we may have to call another meeting.

Mr. SHADBOLT: Then I beg to move the adoption of the resolutions.

Mr. OCTAVIUS THOMAS seconded the motion.

Mr. T. BERRIDGE (Leamington) said that before the resolutions were put, he should like to express the wish that the Committee would in future call the meetings of the Benevolent Fund before the general meetings of the Institution. In his opinion, and in that of a good many of the contributors to the fund, the affair had been managed in a kind of hole-in-a-corner way. The meetings had been called when the members were thoroughly tired, and at the end of long discussions. Then the proceedings at meetings of the subscribers had been rushed through in about five minutes. No accounts were published; and no names of those who had received grants were put before the members. The result was that the fund did not receive the proper amount of support. He wanted to be assured that the meetings would be called at a time when the members were in a fit condition to attend to the business.

The PRESIDENT said it had been expressed over and over again that it had been a great mistake to hold the meetings of the Benevolent Fund at the end of a long sitting. He thought in future they must find a more opportune time for them; but, with regard to the question of the accounts, they were published and circulated among the subscribers. He took it that it would not be in accordance with the rules if they were to publish the names of the recipients of the fund, and neither did he think it would be wise on the part of the Committee to do that. However, he thought the contributors might take it that, at all events this year (he could not speak for more), they would take the opportunity of holding the meeting when a good number of members were present. Mr. Berridge was quite right. They would have the meeting when they were not tired and so wanted to get away. The fund was worthy of a better position in their proceedings.

The resolution was then carried unanimously; and this concluded the first meeting under the new order of things.

THE ACETYLENE ASSOCIATION.

Second Annual Meeting.

It will be remembered that early last year an Association bearing the above name was started, having for its aim the advancement of acetylene gas engineering and manufacture in the interests of the public and of the industry. That much useful work has already been accomplished, was made abundantly clear from the details given by the Chairman (Mr. F. G. Worth) at the second annual general meeting of the Association, which took place last Thursday, at the Westminster Palace Hotel. A very representative (if not particularly numerous) company took part in the proceedings, which, however, consisted in the main of what is known as "general business."

The Chairman opened the meeting with a short, but interesting, address, in the course of which he referred briefly to what had been done during the past year towards the furthering of the objects which the Association have at heart. He stated that, within a few days of the last annual meeting, the Council met and discussed the points then raised as to the safety of generators, the standard quality of carbide, and the attitude adopted by the railway companies towards the industry. Subsequently, the views of the members were asked for on these matters; and a large number of replies were received. Committees were then appointed to deal with the subjects of generators, carbide of calcium, and purifiers. The reports of the Committees were submitted to the Council; and some of the suggestions of the honorary members who served on the Home Office Committee on Generators* were adopted.

CONDITIONS OF SAFETY FOR GENERATORS.

Dealing with the regulations issued by the Association for the purpose of ensuring safety in the working of acetylene generators, the Chairman explained that, in the first instance, a list of proposed regulations was drafted by the Council, and copies were sent to the members who had acted on the Home Office Committee, and also to the Home Office. The only important points whereon there was divergence between the suggested regulations of the Association and the conditions recommended by the Home Office, were as to the pressure allowable in the apparatus and in the service-pipes. In order that these questions might be discussed, the Home Office authorities arranged to receive a deputation from the Association. The latter had proposed that the limit of pressure in any part of a generator should be that of 50 inches of water; and they had further recommended that the pressure in service-pipes within a house should not exceed 10 inches of water. These points were discussed at great length, every member of the Home Office Committee

* See "JOURNAL," Vol. LXXIX., pp. 693, 725.

and of the deputation taking part; and the result was that Captain Thomson (the Chief Inspector of the Home Office and the Chairman of the Committee) stated that the Home Office would be quite agreeable to consider any recommendation from the Association as to apparatus which, from conditions other than ordinary, might reasonably claim to be exempted from the 20 inches limit. It was felt to be most desirable that the regulations of the Association should coincide in the main with those of the Home Office; and it was suggested by the deputation that this difference might be met by allowing the Association to exempt any special apparatus up to 50 inches pressure—such exemption to be granted subject to the approval of the Home Office. With regard to the second point—the pressure in service-mains—this was dealt with in the same way, except that in this instance the Association might grant exemption for higher pressure within the house without the approval of the Home Office. There was only one firm of generator makers among those who submitted to the Home Office tests in whose apparatus the pressure now exceeded 20 inches; and this firm had been requested to allow of an expert examination of their apparatus, so that in the event of its being proved free from danger, the Association might recommend exemption and ask for the approval of the Home Office. It was the earnest desire of the Council not to do anything to prejudice the position of the firm in question; but the Association having issued regulations, they must uphold them. A final attempt would be made to induce the firm to submit their machines to a reasonable test; and later on the meeting would be asked to express an opinion as to the course that should be adopted in the event of the firm remaining obdurate. It would, of course, be a satisfaction to the members to have received (if he might use the expression) official Home Office recognition of the utility of the Association; and he believed he might add that the Public Control Department of the London County Council, and a great number of local authorities throughout the country, thought equally highly of it.

Railway Charges for Carbide of Calcium.

Another point, said the Chairman, to which the greatest importance was attached was the rates of carriage for carbide of calcium, and the hardship of having to pay exceptional charges on account of its supposed dangerous qualities. After full discussion and considerable correspondence, the Committee of Railway Companies' Managers received a deputation from the Association, when a statement of the grievances complained of was put before them, as well as suggested modifications. One of the honorary members (Dr. Boverton Redwood) kindly consented to join this deputation; and he pointed out that the existing regulations really assisted in fostering the view that carbide of calcium was a very dangerous product. The time had, therefore, he thought, come when the Railway Companies should modify their attitude. A point which he (the Chairman) dwelt upon was the hampering effect of the compulsory use of the special consignment note, in which carbide was classed among extremely dangerous goods, and of the restriction to certain days and particular trains only. The deputation concluded by asking that the Committee should take into favourable consideration the following requests of the Association: (1) That carbide of calcium should be carried at second-class rates; (2) that it should be removed from the "Dangerous Goods" classification; (3) that the present "Dangerous Goods" consignment note for it should be abolished; (4) that carbide should be carried by all trains, and with other goods—including moderate quantities by passenger trains; (5) that the requirements by railway carriers as to covered vans should be modified; and (6) that when railway companies were steamship owners, carbide should be carried at through rates, and not left on pier as at present. The Council had pleasure in reporting that, though the Railway Companies did not yet see their way to carry carbide at reduced rates, they had prepared a special consignment note (which would come into force on March 1 next) for carbide of calcium as a separate product, with the omission of the "Dangerous Goods" classification. While regretting that more could not be conceded, it was felt that this was a step in the right direction; and at a future date, the Council intended to again approach the railway managers, with the object of getting them to recommend that carbide should be carried at second-class instead of third-class rates. What the Council believed would influence these gentlemen more than anything else in modifying their present decision would be to show that the reduction of the charge for carriage would mean a very large increase of traffic, not only in carbide, but also in generators, purifiers, fittings, and other appliances connected with the acetylene industry. He also pointed out that in many other directions the Association had done useful work, including the removal of difficulties which occurred through the working of the Petroleum Acts as applied to carbide of calcium being interpreted in a sense not intended by the Order in Council.

The Balance-Sheet.

Referring to the accounts of the Association, the Chairman remarked that on Feb. 28, 1902, the balance in hand was £71 3s. 5d.; while the receipts up to Dec. 31 amounted to £43 5s. 0d. The expenditure had totalled up to £95 2s. 8d.; so that at the close of the year they were £19 5s. 9d. to the good.

The Official Organ of the Association.

The report of the Council and the balance-sheet having been adopted, it was resolved, on the motion of Mr. Washington Hume, seconded by Sir C. Stewart Forbes, Bart., that the "Journal of Acetylene Gas Lighting"—or whatever other name it might be thought fit to give it later on—should continue to be the official organ of the Association, it being left in the hands of the Council to carry out such arrangements as they might deem advisable for improving the circulation of the paper, and making it worthily represent them.

Pressure Limit for Generators—A Recalcitrant Firm.

The next matter discussed was with regard to the firm of generator makers referred to in the Chairman's address, who had refused to conform to the regulations issued by the Association. The name of the firm was not mentioned, but many of those present were well aware what apparatus was alluded to. The Chairman, in introducing the question, remarked that they were all satisfied that the generator was safe working at the higher pressure; but as the regulations stated that anyone going beyond 20 inches pressure must have an exemption, they thought every member of the Association ought to comply with this rule. The Council had offered to look thoroughly into the plant, and to recommend exemption to the Home Office if they found it safe. The makers, however, demurred to this—saying that the apparatus had been at work for several years without any accident having happened to it. The Council suggested that the firm should be given a further opportunity for permitting an examination of the generator by the Association; but they were anxious to have the opinion of the meeting as to what course should be adopted if the offending firm still refused to be convinced. Mr. Washington Hume said he certainly thought that in a case of this sort no active steps should be taken until their attention was called to the matter. If the Home Office asked their opinion, then they ought to recommend that the regulations should be adhered to. All they could do was to ask the firm to resign their membership of the Association. Mr. W. Doman believed that it was not the conviction of the Association that a pressure of 50 inches was dangerous. The Chairman agreed, but pointed out that it was clearly set forth in their regulations that the limit should be 20 inches. It was quite easy to make a generator that would stand much more than 50 inches pressure; but the tendency might be to construct them in too flimsy a manner. The original recommendation of the Council was a limit of 50 inches pressure; but the Home Office reduced this to 20 inches. For a long time everybody thought that 100 inches had been fixed by the Home Office as the limit; but this was a mistake. Out of the whole number of generators on the English market, there were certainly not more than two or three which went beyond 20 inches. The firm in question objected to the expense of a test by an expert; but the Association might meet them in some way. Mr. Washington Hume remarked that the firm were running a risk, seeing that the Home Office or any authority could come down upon them at any moment. The Chairman said even the Home Office themselves admitted that there was no danger at 50 inches pressure; but they said they wanted to fix the limit at the figure they thought best, and there was no getting over this. After further conversation, Mr. F. L. Rawson offered to test the apparatus free of charge; and the matter was allowed to stand over, so as to give the firm another chance of submitting to the Association.

Tests of Purifiers and Purifying Material.

The Chairman next stated that they were proposing to carry out some tests of purifiers and purifying materials. It was a well-known fact that with some purifying material explosions had occurred; and some of these had been serious in a way, though they had not, to his knowledge, caused loss of life or limb. There had, however, been a good many accidents; and it was easy to imagine acetylene plants getting a bad name if the purifier "went off pop" the moment it was separated from the generator. It had been suggested that the tests should be carried out by Mr. J. W. Gatehouse, of Bath, who was a well-known, capable man; and as soon as they could get the purifiers and material, the work would be commenced. It had been thought desirable that they should act in accord with the Home Office also with regard to these tests; and the Executive would be seeing Captain Thomson on the subject in the course of a few days. The tests would be very useful to the industry, as showing that the purifiers and purifying material used in this country were safe. It must be a satisfaction to them all to know that there had not been the explosions and troubles in England that had taken place in some parts of the Continent, where they had been very frequent indeed.

Election of Officers.

Mr. Worth was re-elected Chairman of the Association; Sir Charles S. Forbes, Bart., Vice-Chairman; Mr. C. Bingham, Treasurer; Mr. J. R. Fawkner, Representative of the Official Organ; and Messrs. Fitzpatrick and Co., Auditors. Two new Members of Council were elected—Mr. A. T. Booth and Mr. H. Leigh-Bennett; the latter gentleman being afterwards appointed second Vice-Chairman, in place of Mr. F. W. Harker, who is leaving England.

Votes of thanks to the Chairman, Treasurer, Auditors, and Secretary (Mr. Lacey Downes) concluded the meeting.

THE MECHANICAL HANDLING OF MATERIAL.

This was the topic of a paper presented by Mr. George F. Zimmer, Assoc.M.Inst.C.E., at the meeting of the Institution of Civil Engineers last Tuesday. The name of the author will be recognized as that of the inventor of the swinging form of conveyor, about which so much was heard in connection with the Zurich Gas-Works, but which conveyor has not obtained a large adoption in this country for the handling of gas-works material although we believe that in some other branches of industry it has, found greater favour. Much credit is due to the inventor for the ingenious simplicity of his conveyor; but we are sorry that it is impossible to compliment him upon the quality, at this time of day, of a large part of the material composing the paper which he put before the Institution. That large part is, to say the least, extremely elementary; and it is safe to say that gas engineers who have been studying for years past the question of the mechanical handling of the materials with which they have to deal, will not find much to instruct them in the paper. As has been before stated, the Institution do not permit the publication of their papers; and in regard to this one the merest indication of its contents will suffice.

The author prefaced the main part of the paper with a reference to the economy which is effected by the mechanical handling of material; and he advanced the view that, in round figures, it may be taken that the saving of one man's wages warrants the investment of £1000 in machinery. At the same time, he asked that it should not be rashly assumed that the multiplication of mechanical appliances is detrimental to the interests of the worker. On the contrary, his daily life is thereby made easier, his intelligence is improved, and his wage-earning capacity is increased. Dropping into his subject proper, he dealt with it in the divisions of elevators, conveyors, and appliances which combine both elevating and conveying. The first principles of elevator construction were once more explained; and then some information followed on the question of the positions of elevators and their speed of running—the one, of course, bearing upon the other. Elevators in a vertical position are suitable only for specifically light materials; and they can be run at a circumferential velocity of from 250 to 350 feet per minute. Elevators for heavy materials must be either wholly or partially inclined, to give clean delivery without scattering at the much lower speed of 50 to 160 feet per minute. It is for this reason of speed that elevators for specially heavy materials require so much larger buckets, chains, &c., than (say) grain elevators of the same capacity. There is a second reason why it is essential to run an elevator for heavy materials up an incline; and it is that the elevator is more easily driven, for part of the load is then borne by the inclined supports, instead of the whole weight hanging from the driving gear, as in the vertical elevator. The angle at which to fix an elevator, in order to get the most favourable results without occupying two much space, is 45° to 60°. The author gave the delivering capacity of coal-elevators with buckets of 12, 18, and 24 inches wide, a pitch of 18 inches, and a travel of 120 feet per minute, as 20, 30, and 40 tons respectively. Regarding the allowance of power for elevators, the author puts it for practical purposes at not less than twice the theoretical horse power.

In the section of the paper on conveyors, Mr. Zimmer dealt with the different types that have been introduced in the order of their age. The older forms were used for soft and light material; and so they need not be noticed here. Coming to push-plate conveyors, the author's description presented nothing new. On the point of capacity, this, of course, depends on three factors—the size of the trough, pitch of plates, and speed of travel. It may be said that the pitch of the plates ranges from 18 inches to 3 feet, and the speed of travel between 60 and 180 feet per minute. For coke and other friable substances, the speed should not exceed 60 to 90 feet per minute; while in cases where breakage of the material is of merely minor consequence, the maximum speed—180 feet per minute—might be employed. For example, a conveyor, with a trough 24 inches wide, having the plates 24 inches apart, and running at a speed of 100 feet per minute, would convey 30 tons of coal per hour. Another push-plate conveyor, with a steel trough 20 inches wide, with the plates 18 inches apart, and running at a speed of about 180 feet per minute, has a capacity of 40 tons per hour. A push-plate conveyor for hot coke with a 27-inch trough, and with malleable iron plates 24 inches apart, running at about 48 feet per minute, delivers about 20 tons of coke per hour. The power required to drive a push-plate conveyor depends upon the nature of the material to be conveyed, and on the condition of the trough. For instance, cement, clinker, and coke would require more power for their conveyance than coal; but "as the push-plate conveyor is altogether unsuited for hard and cutting substances, on account of the great wear and tear," the author only gives figures based on coal conveying. A push-plate conveyor, 100 feet long, conveying coal at the rate of 50 tons an hour, will require a driving power of 12-horse power.

Band conveyors for grain received considerable attention from the author; and then he mentioned that these were adapted to the transit of coal, coke, minerals, &c., by making the fittings throughout more substantial, with stronger bands; the middle portions, being subjected to the greatest wear and tear, receiving special attention from the makers. The speed of these conveyors differs widely, according to the nature of the minerals. It is not so much the specific gravity which determines the speed as the size of the pieces to be conveyed. The best speed for large pieces is 150 to 200 feet a minute; and the speed increases as the size of the material decreases, up to a maximum speed of 500 feet to 600 feet per minute. Mr. Zimmer gave a table, showing the approximate capacity in tons of coal per hour, of different sized belts, with their respective speeds, and the horse power required for lengths of 100 feet, with in all cases speeds of from 150 to 600 feet per minute. A band 12 inches wide has a capacity of from 10 to 35 tons per hour (from 2-inch cubes to dust); an 18-inch one, from 50 to 175 tons (4-inch to ¾-inch cubes); a 24-inch one, 125 to 475 tons (6-inch to 1-inch cubes); a 30-inch one, 250 to 900 tons (7-inch to 2-inch cubes); and a 36-inch one, 350 to 1500 tons (9-inch to 2-inch cubes). The brake horse power for a conveyor 100 feet long would be for the bands in the order named 3·2, 4·8, 6·0, 7·6, and 9·2. These horse powers are for horizontal belts; if inclined, the power varies accordingly. The advantages and disadvantages of band conveyors are well known; and the author's remarks thereon need not here be noted. Travelling trough conveyors come in for a little attention. This type consists of an endless trough, the sections of which are rivetted to the links of suitable chains; and they travel at the rate of 60 to 120 feet per minute. The author submits that this type is better than the push-plate conveyor, inasmuch as it takes less power, and does not damage the material by breaking it. But it is a disadvantage that with this type intermediate delivery is altogether excluded.

Then we come to the special form of conveyor with which the author is intimately connected; but while he devotes himself to it to greater length than in the case of the other conveyors, he does not take the liberty with his opportunity that might have tempted many others. The principle of the vibrating or swinging conveyor is known to readers who have interested themselves in the descriptions in these pages from time to time. To put it briefly, the conveyor is constructed of troughs which receive the material to be conveyed at one end and deliver it at the other by means of a succession of suitable backward and forward movements of the troughs. There are several varieties of the vibrating trough conveyor. In some, reciprocating movement of the trough is effected by means of a crank and connecting-rod, while the trough itself is supported on rollers or portions of rollers; in others, the trough is actuated by a cam or by cranks with some kind of quick return motion. The support of the trough in its reciprocating motion has been effected by links and by flexible legs in an oblique position, as well as by the rollers mentioned. The latter form is in more general use, for two reasons: First the spring legs are securely bolted at one end to the floor or other support, and at the other to the conveyor trough itself, and consequently they require no lubrication. Secondly, the combination of the reciprocating motion of the trough and the rocking of flexible legs causes the material to travel faster in the trough, for a given stroke of the crank, than with any other means of support. This is how the author describes the movement of the material in the trough: "If the trough is full, the material moves, as it were, in a solid mass. There is no friction between the particles of material, nor between the trough and the product, as it is a hopping and not a sliding motion which takes place." The material travels at the rate of from 40 to 70 feet per minute when the conveyor is driven at 300 revolutions to 350 revolutions per minute. The conveyor can be used to work partly in one direction and partly in another by simply reversing the inclination of the spring legs, and by joining the trough at the junctions in a flexible manner. The load can also be fed into, or withdrawn from, any of the conveyors at any number of points, without cessation of work. There appears to be no limit to the length or width of conveyors of this class, as they are at work in lengths of 300 feet, and as wide as 6 ft. 6 in.; and the author does not see any reason why these dimensions should not be exceeded. To the simplicity of the conveyor and the small driving power required, he ascribes its success. The power needed to drive the conveyors may be judged from the following example: A swinging conveyor 100 feet long, conveying a load of 50 tons per hour, will require 8·75-horse power.

The paper included a table giving the capacity in tons per hour of this form of conveyor in widths ranging from 12 to 72 inches, and depths of 4 to 8 inches. A 12 inch wide conveyor of a depth of 4 inches will carry 6 to 7 tons an hour; with an increase of 2 inches in depth, the capacity would be raised to 9 to 10 tons per hour. Take next a 24-inch wide conveyor; and its capacities are entered for depths of 4, 6, and 8 inches at 13 to 15 tons, 18 to 20 tons, 25 to 30 tons respectively. A 72-inch conveyor, 6 inches deep, is credited with a capacity of 50 to 60 tons; and one of like width and of 8 inches in depth will carry 70 to 80 tons. These are only examples from the table; and the capacities are for conveyors running horizontally. An incline of only 5 per cent. downwards will increase the capacities about 10 per cent.; while an incline upwards will reduce them correspondingly.

In dealing with the advantages of swinging conveyors, the author states that they will convey any kind of material in large or small pieces; and, however friable the material may be, they will not break it. Some gas managers will regard this statement as a little too sweeping when applied to coke; but the question of breakage in the case of coal in gas-works is not of

importance. We have referred to two or three installations in the "JOURNAL" on previous occasions; and in the paper the author shortly describes an installation for the transit of coal at the Brentwood Gas-Works. The coal is received in railway trucks which are emptied by means of hydraulic lifting gear into a hopper, whence it passes through a pair of breaking-rollers to the elevator, which in its turn delivers the coal *viâ* a swinging conveyor to the coal-store, or to a series of hoppers from which the supply for the retorts is drawn. When these hoppers are empty, coal can be taken from the store by means of a second swinging conveyor in a tunnel below the store, and be passed to the elevator and conveyor to replenish the hoppers.

The author included in his paper (which covered 49 printed octavo pages) the large table on the cost of maintenance of elevating and conveying plant prepared by the late Mr. W. R. Chester for his contribution to the Gas Section of the Glasgow Engineering Congress in 1901; but Mr. Zimmer has extended it by one line which gives the information that a swinging conveyor at a first total cost of £1767 (or £1 0s. 6d. per lineal foot) would transport 250,000 tons of coal. The distance of traverse (21 conveyors) would be 1722 feet. The cost for repairs and renewals would be: Total £15; per ton, 0·114d.; and per ton for 100 feet of traverse 0·0003d. These figures were obtained from the Engineer of the Zurich Gas-Works, where a number of swinging conveyors have been at work for more than four years past. Readers will be able to apply the figures to Mr. Chester's table, without reprinting it here.

The travelling bucket conveyor also receives notice; but the remainder of the paper contains nothing of special interest to gas engineers. This sketch of the portion of the contents which more directly appeals to them will suffice to convey an idea of the character of this contribution to a subject the importance of which in large operations demanding the moving of considerable bulks of material cannot be over-estimated.

RECENT IMPROVEMENTS IN GAS-ENGINES.

At the Meeting of the Manchester Association of Engineers last Saturday, a paper on the above subject was read by Mr. JAMES ATKINSON, M. Inst. Mech. E., of Messrs. Crossley Bros., Limited. The chair was occupied by the President (Mr. E. G. Constantine); and there was a large attendance of members. In the course of his paper the author said:

In 1894, the author had the honour of reading a paper before this Association on the same subject, in which he had an opportunity of bringing before your notice some of the advances which had up to that time been effected in the improvements of gas-engines. In the interval between then and now, the gas-engine has been developing at a rapid rate; and the time is fast approaching when the steam-engine will have to take a secondary position as a power producer. At the present time, every engineer who has considered the question agrees that a gas-engine, with a suitable gas-producer, will generate power at a cheaper rate than any steam-engine and steam-boiler ever made—it might almost be said, that ever can be made. The majority of our best engineers during the last fifty years have devoted their energies to the steam-engine; but all their efforts with increased pressures, multiple expansion, and superheating fail to enable it to compete in economy with the gas-engine, though until recently the latter has only had a small minority of people who have really given their serious efforts and time to its development. Increase of size and increased compression pressures are the most marked feature in the present development of gas-engines. These increases have necessitated modifications in certain parts; and this paper will mainly deal with these modifications.

Strains due to increased heat, increased pressures, and the operation of large valves, have gone beyond the capabilities of older designs; and new features are essential to enable these larger modern engines to stand. In this connection, it is necessary to discriminate, and to consider the particular conditions under which the engines are to work. For instance, some very large engines have been made and put to work, chiefly on the Continent, some of them mainly constructed on the lines of engines as made in this country ten years ago. Such engines would not work for an hour with ordinary illuminating gas at anything like full load. They are working with gas of low calorific value, consequently at cylinder temperatures considerably below those common to even small engines in general use; also, when driven by blast-furnace gas, there is a greatly-reduced risk of preignition, owing to there only being (say) 2 per cent. of hydrogen in the gas. In such engines, therefore, it is scarcely necessary to take the precautions which are absolutely essential in large engines working with richer gas, or gas containing a larger proportion of hydrogen—such as ordinary town gas, producer gas, or water gas.

[The author here exhibited diagrams showing the cylinder end of large engines as now made by Messrs. Crossley Bros., having improvements in the method of constructing the main casting, watered exhaust-valve, watered piston, and compensating piston on the exhaust-valve.]

Proceeding, Mr. Atkinson remarked: It will be seen that the exhaust-valve box is now a separate casting; thus removing one of the main causes of the fractured breech-ends, which may be said to have been one of the chief sources of trouble with large engines. The inner metal surrounding the combustion chamber is cast quite free from the outside metal, excepting where joined to the outer metal by the branches to the exhaust-valve at the bottom, and to the admission-valve on one side. A casting is thus obtained which is free from all casting strains. Lugs are cast in the inner and outer metals, which are drilled, tapped, and have screwed stays inserted binding the two together. A large opening is formed at the back, fitted with a thin cover. This gives ample access for cleaning; and the large opening tends to the soundness of the casting. Also, in case of frost freezing the water in the jacket, the plate would probably give way, and thus save the main casting. The metal surrounding the combustion chamber can be thin, as the strength is thoroughly reinforced by ribs and by the connections to the outer metal. It is very satisfactory to note that, since this mode of construction was adopted, there has never been a case of a single breech-end giving way, though there are a considerable number of engines running fitted with them, in some instances working night and day on very heavy constant loads. The author believes that it would have been impossible to have constructed such engines with the older types of breech-ends without having constant breakdowns from fractures.

Increased size has led to the necessity of circulating water through the exhaust-valve. Fig. 1 shows the method now adopted, and is self-explanatory. The main piston also has to have a watered end, so that in these large cylinders there is no part exposed to the hot working fluid which has not got water on the other side, with the exception of the head of the inlet-valve, which is kept cool by the admission of each fresh charge. This appears to be the only satisfactory method by which pre-ignition can be prevented, though some of the Continental makers place the admission-valve head facing the exhaust-valve head in a narrow port or passage communicating with the combustion chamber. The incoming fresh charges thus keep both the admission-valve and the exhaust-valve cool. This arrangement has something to recommend it; but it cannot be so satisfactory, as it makes a combustion chamber which is both uneconomical and very difficult to clean out without removing the piston—a somewhat heavy job with a large engine. By removing the air-valve block, the whole of the interior can be examined and cleaned; also any dirt, burnt oil, or scale drops out through the exhaust-valve passage. In larger engines, it is an advantage to be able to slide the exhaust-valve out horizontally, as it is of considerable weight.

When it is realized that large engines frequently have a pressure of 50 lbs. per square inch in the cylinder, when the exhaust-valve commences to be opened, and that a valve of considerable size is necessary, it will be understood what a great improvement it is to use a compensating piston to relieve this load, which often runs into tons. Exhaust-valves in large engines have to be operated (say) perhaps sixty times a minute, usually by means of a cam on the side shaft, a roller, and a lever. If the heavy load is not relieved, the cam wears very fast just at the point of opening; and once it gets out of shape, the trouble increases. The same applies to the gear-wheels driving the side-shaft, which also wear at a rapid rate at this one place, thus intensifying the evil.

In the paper read before you in 1894, an arrangement was described for scavenging out the burnt gases; and it has proved satisfactory—being now at work on some hundreds of engines. At the present time, there is not so much advantage to be derived from scavenging, as compression pressures having gone up, combustion chambers are reduced in volume, and there is a smaller volume of residual gases to remove. The possible saving in gas is thus not so great, nor can as large an increase in power be obtained. Nevertheless, there are many instances in which it is desirable to use the long exhaust-pipe and special setting of cams. One difficulty which cropped up in connection with this arrangement was an unexpected one—viz., the noise of the exhaust increased, and in many instances it has been necessary to arrange for special silencing arrangements which would not otherwise have been necessary. In this connection, in some instances, the noise of the exhaust has been successfully reduced to practical silence by putting the ordinary silencers in a pit filled with large stones, and having an outlet from this pit.

The use of large engines for driving direct-coupled dynamos for various purposes, is rapidly coming to the front. In some instances, when used (say) for electro-chemical processes, large engines are now running night and day on their full output. It is needless to say that this means a most severe and exhaustive test of every part of the engine—a year's run on such a duty being at least equal to three years' ordinary work—and it is most satisfactory to be able to say that there are now many such instances. In one case, an engine of 400-horse power ran seven months continuously without being stopped. There are instances of large engines running 97 per cent. of the total hours in the year; the 3 per cent. including stoppages due to all causes, either affecting the engine or the electrical part of the combination. In another case, four engines are on constant day and night work in one engine-house, each on a load of 300 kilowatts. The requirements of the electrician for steadiness in running and accurate governing have now got far beyond anything anticipated some

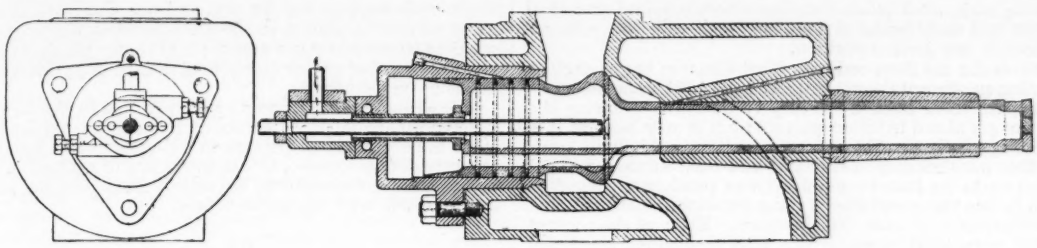


FIG. 1.

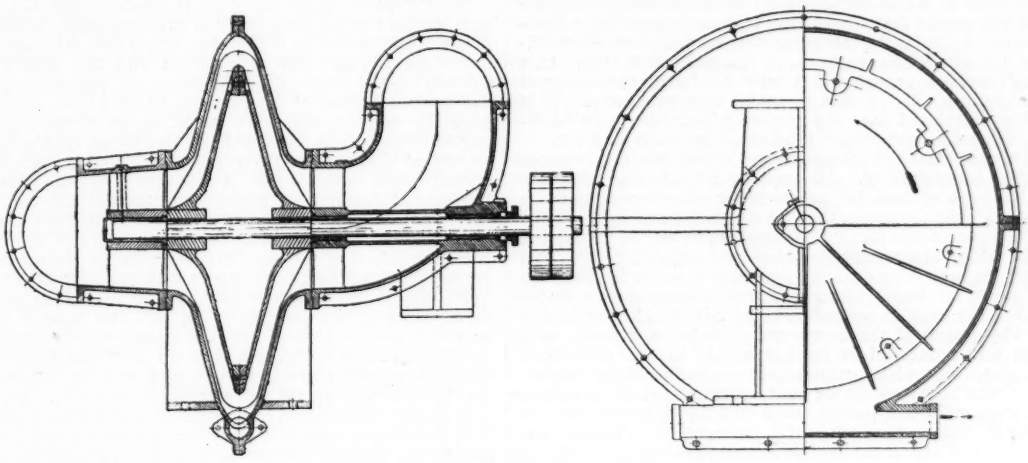


FIG. 2.

years ago; but, as in most mechanical matters, when the need arises and is sufficiently emphasized, the solution is found.

For very accurate regularity of turning, and with large engines of the four-stroke or "Otto" cycle, it is desirable to use four cylinders in any suitable combination, and to use an impulse automatically regulated by the governor. Such an engine will, if properly constructed, give almost perfect regularity; and it is interesting to note that the inertia of the reciprocating parts, in many instances, just about compensates for the high initial pressure of each ignition, and levels-up the falling pressure towards the end of the stroke—giving a very uniform turning moment to the crank-pin. It is also very convenient that in gas-engine design it is not necessary to have a very powerful governor, so that the full range of power can be controlled without much variation in speed between full load and no load. In two engines recently tested by the author, this maximum variation did not exceed 0·75 per cent.

The arrangement of automatic cut-off gear consists of a multi-ported cylindrical valve sliding inside the casing of the admission-valve. This valve is driven by a small eccentric through a lever which has a moveable fulcrum controlled by the governor through (it may be) right and left hand threads. The pitch of the threads is such that any thrust on the fulcrum will barely tend to move the nut on the right and left handed threads; but as there is a push and a pull for each admission, the governor requires scarcely any power to enable it to move the nut one way or the other at these times. Consequently, it can take up a new position to suit the power requirements without it being needful to exert anything beyond an extremely small amount of effort. Owing to this, the governor itself can be made almost isochronous. In tests which have been made with this particular gear, it has been found that the gas consumption is about the same as with a hit-and-miss governed engine, from full load down to nearly half load; but below half load the hit-and-miss governor has the advantage. If the automatic gear is adjusted to give very light impulses, so as to run the engine without load, and without missing, the hit-and-miss governing is from two to three times more economical. For these reasons, the gear is so arranged that it may be adjusted to give hit-and-miss governing at and below any desired load.

The hot-tube ignition still continues to hold its own; and when suitable gas is available, it is impossible to beat it for stationary engines. The metal tubes, however, have almost entirely disappeared; and long-life porcelain tubes are now universal. When two tubes are fitted to an engine, each with its own chimney and flame, its own separate ignition valve and gear, with means of shutting either off so as to replace a burst tube without stopping, it looks almost as if there were not much chance of development or improvement in this direction.

There are numerous instances, however, where a suitable gas supply is not available, and electric ignition has to be used. For this purpose, batteries of any kind are an intolerable nuisance. They may possibly be desirable for motor-car work; but unless a constant supply of electricity is "on tap," small dynamo machines are undoubtedly the best. These are usually constructed with permanent magnets, arranged to give a substantial spark of equal intensity either at starting or during running at any speed, have means for adjusting the timing of the spark while at work, and as made by any good firm are a good, durable, serviceable job. Still, the double-tube ignition is undoubtedly the best, when it can be used. It is, however, difficult in some cases to persuade purchasers in their own interests to have tube ignition, as they frequently insist on having electric ignition.

Gas-producers for making suitable gas out of almost any kind of fuel have in recent years very greatly progressed, and thus added impetus to gas-engines both large and small. The gas-engine user can now be independent of the gas-works; and combined installations of gas-engines and gas-plants are now common all over the world. Dowson gas has been in satisfactory use for a number of years; but the fuel employed was limited to anthracite or coke. There are now many makes of small simple plants which can be put down almost anywhere, and relied on to do their work admirably, using anthracite coal or coke, which, in a general way, may be said to be the best fuel for small powers. For larger powers, plants can now be obtained using bituminous coal of common slack quality. The engines driving Messrs. Crossley Bros.' works have been running with the gas from such a plant for some two years. When first the plant was erected, there was a good deal of trouble caused by tar passing away with the gas, and interfering with the proper action of the valves in the engines; and this tar difficulty still exists in some bituminous gas-plants working. In the above instance, however, modifications in the plant and the addition of a special "tar-separator" completely overcame the difficulty; and the gas is practically as clean as that supplied by the Manchester Corporation, so far as regards any impurities which can prejudicially affect gas-engines.

As the "tar-separator" is quite an important part of this bituminous coal plant, it is illustrated in fig. 2. It consists of a disc, which is revolved at a very high speed, and has on each side a number of radial blades almost fitting the casing, as shown. The gas comes in at the centre on one side, and passes outwards on this side of the disc, being put into circular motion which gradually increases to an extremely high speed as it turns round the edge of the disc. It then passes inwards at a reducing speed, till it leaves in the centre on the other side. The gas to be cleaned is either loaded with moisture as it comes from the cooling towers, or a little water may be admitted with it. This water, and any tar, dust, or other impurities are thrown outwards at the edge of the disc, and carried round till they escape at the outlet at the bottom. The great advantage of the separator is that, though it takes a great deal of power to put the gas up to such a high circular speed, the bulk of the power is returned to the disc as the gas slows-down in again approaching the centre on the outlet side. Both anthracite and bituminous gas plants can be operated so as to make the gas just as fast as it may be required, without needing any holder—thus doing away with a cumbersome and expensive part. In a large works, the motive power for any particular shop can be obtained from an engine or engines in the shop itself. It does not cost anything beyond the first outlay on the gas-mains to carry the gas to the engines, so that a gas-producing plant,

distributing mains, and isolated engines where required give ideal conditions, and each pound of common slack will give a horse-power-hour in any desired position.

The use of the gas from ordinary blast-furnaces in gas-engines is a burning question at the present time. English manufacturers of gas-engines have been frequently twitted with allowing the foreigner to get ahead in this departure; but it may be that it is the English proprietors of blast-furnaces who are mainly to blame. Gas-engines were running in England with blast-furnace gas, and the economy to be thereby obtained was publicly preached in England, before the question was taken up on the Continent; but the manufacturers of iron did not move. Even at the present time some very large steam-driven blowing-engines are being constructed, in face of the fact that they will require five or six times the amount of gas (burned under the steam-boilers), supplying them with steam that would have sufficed in gas-driven blowing-engines. To use blast-furnace gas by burning it under steam-boilers is a waste which is sure to be stopped before long. In a few years' time, it is probable that only blast-furnaces equipped with gas-engines will be able to make iron profitably. It is reasonably calculated that the use of gas-engines with blast-furnaces will reduce the cost of production by 5s. to 8s. a ton.

There is one feature of the gas-engine which does not develop, and that is compounding. An engineer accustomed to steam-engines has been so used to the enormous advantages gained in compounding steam-engines that he cannot stand opening the exhaust of a gas-engine into the atmosphere at 40 lbs. per square inch. In 1884, the author patented and constructed a compound gas-engine. The ordinary cylinder was one in which an impulse every revolution was made; and a compound cylinder was fixed at the back, the cylinders being axially in line with each other. The piston of the compound cylinder was made very light, and was connected by light side-rods to the cross-head of the engine. The whole arrangement worked perfectly satisfactorily, and was kept running for over a year. There was a slight gain per indicated horse power, and a still less gain per effective horse power, but nothing to justify the extra cost, beyond the fact that to some extent the engine was double-acting, giving out power twice per revolution, and the exhaust was very quiet. Ultimately, the compound cylinder was taken off; and the engine subsequently worked in the ordinary manner.

In 1899, Messrs. Crossley Bros. constructed a compound gas-engine having three vertical cylinders, two high-pressure cylinders working on the "Otto" or four-stroke cycle on the outsides, with a compound cylinder in the middle; the two high-pressure cranks being in line with each other, and opposite to the low-pressure crank. The working impulses took place alternately in the high-pressure cylinders, and alternately exhausted into the low-pressure cylinder, which thus gave out power once per revolution. As the high-pressure cylinders also between them gave out power during the other strokes, the engine had two power strokes per revolution. The connecting passages between the cylinders were short, the fluid was perfectly controlled by a suitable piston-valve, and the engine ran quite satisfactorily. Again, however, "the game was not worth the candle." The economy was very slight; and there was very little chance of the public paying for the increased cost, which, of course, would be considerable. It looks as if any increased expansion beyond the original volume of the charge can only be got satisfactorily in one cylinder, and even if so obtained it is at increased capital cost per unit of power.

Single-cycle engines, which give a working stroke with a single-acting cylinder once per revolution, are again coming to the front. The author, between the years 1878 and 1893, made several types of engines, the details of which most of the members will recollect. In each case, they were single-cycle engines, but probably before their time, as the public demanded "Otto" type engines, and would have nothing else.

In the Körting engine, a single-cycle engine is made double-acting, so that it gives two working strokes per revolution, like a single-cylinder steam-engine. This requires a piston-rod passing into one of the combustion chambers, with the attendant loss of about 9 per cent. in economy, and 9 per cent. in power at this end, or half as much for the whole engine. This loss is shown by the published particulars, and is confirmed by there being a similar, though greater, loss in the double-acting Griffin engine as tested at the Society of Arts trials. It does not, however, follow that it is not good practice to incur this loss for the sake of other advantages. Large gas-engines are at the best a compromise; and when working with blast-furnace gas, or cheap producer gas, the extra cost for gas is very slight. In very large engines, the cooling surface of a piston-rod, or some similar kind of surface, may be necessary to prevent pre-ignition.

It is difficult to foresee what the developments in gas-engines in the immediate future will be; but it is certain that the purposes for which they will be employed will be enormously extended, and their use greatly increased, even beyond the great numbers now being manufactured, largely owing to the increased use of power gas. It is possible that special requirements will cause special developments, as is to some extent illustrated in the types of engine now so largely made for motor-car purposes, which require to run at very high speeds, and to be as light as possible. Some of these engines weigh only 10 lbs. per horse power—a truly marvellous performance. Developments are probable, by making double-cylinder double-acting "Otto" type gas-engines, tandem fashion, which can be run at nearly double the speed at which single-cycle engines can be run, and are also more economical, being no dearer than a single-cycle double-acting engine, which requires large air and gas pumps; and three-cylinder type, double and single acting engines of vertical construction, for which there seems to be a demand.

The writer feels that some apology is due to the members for the somewhat disjointed nature of this paper; but he would remind them that developments in gas-engines are now chiefly in separate details, more or less independent of each other, and also that the above descriptions are mainly from personal experience in connection with the author's firm.

Discussion.

Mr. BELLAMY, of Messrs. J. E. H. Andrew and Co., of Stockport, entered into a very detailed criticism of the paper. After commenting upon the difficulties which Mr. Atkinson had admitted as having been experienced with the arrangement for scavenging the combustion chambers of gas-engines, owing to the increased noise of the exhaust, he said that, while agreeing generally with the author's remarks on the economy of the gas-engine *versus* steam, he would not like to be responsible for the statement that the time was fast approaching when the steam-engine would have to take a secondary place. Dealing with the special features of gas-engine construction referred to in the paper, he said he thought it was best to have the combustion chamber quite separate from the outer casing, and that it was desirable that the combustion chamber should be secured more directly to the outer flange, which was bolted to the cylinder. With regard to exhaust-valves, it had been the practice for many years to circulate water through the head of the valve; and this was in general use on comparatively small engines. It was generally recognized that the best design of combustion chamber was the one without passages, and the best arrangement was to have this type of valve working vertically. Mr. Atkinson had drawn attention to the uneconomical design of the combustion chamber adopted by Continental makers, and had ascribed this to the port or passage in which were placed the admission-valve and exhaust-valve heads. An advantage was claimed for the exhaust-valve being horizontal because it could slide out. Bearing in mind that this valve was right under the cylinder, and generally below the floor-line, could it be said to be as easily handled as a light vertical valve which could be drawn out from the top of the cylinder end? The balancing of the exhaust-valve which had been shown was open to objection, because the corresponding piston was exposed to the explosion, which was liable to fasten it, and there would be a serious escape of pressure past the piston into the exhaust through a passage which might appear to have been provided for this purpose Would it not be better to use the simple valve, and construct the cam to open it slowly, and so distribute the strain over a greater period, and in the case of very large engines use two valves? Dealing with the question of governing, Mr. Bellamy said it was now generally recognized that some form of throttle-gear was necessary when gas-engines were directly coupled to dynamos. Some Continental makers had used the cut-off gear, but had discarded it for a very much simpler arrangement which throttled both the air and the gas. From experiments which had been made with the two arrangements—cut-off *versus* throttle—the question of economy was doubtful. It had been a surprise to him to hear the reader of the paper state that it was impossible to beat hot-tube ignition for stationary engines. One of the largest gas-engine makers in the world had practically abandoned tube ignition in favour of magnetic electric ignition for all sizes. Experience had proved that with electric ignition the starting of large gas-engines was easier and more certain, and the ignitions were more regular, especially when using poor gas. The electric ignition gear got rid of the timing valve and ignition-tube, which had always been a source of trouble. Several instances could be cited where tube ignition had been taken off engines in this country, and magnetic electric gear substituted. In his opinion, the electric ignition was as great an advance over the tube as the tube was over the old slide. In conclusion, he said the separation of the tar in the gas was a very serious matter, and the arrangement which the reader of the paper had described appeared to be very similar to what others had used for clearing out the dirt from blast-furnace gas. It was somewhat disappointing that Mr. Atkinson had not given his views upon the inverted type of gas-engine, which was largely favoured by electrical engineers, and was one which had many interesting details.

Mr. BUTTERWORTH thought the time had arrived, after so many years of the "Otto" cycle, when they might expect some radical departure or improvement in gas-engine designs; but the paper had given no indication of this. He would also have desired some information as to the best method of generating fuel gas; with regard to blast-furnace gas, there was generally so much to spare that there was little economy in putting down more expensive engines simply designed to use less gas. With regard to the ordinary type of gas-engine, he thought there was room for great economy in compounding.

Mr. NEILSON remarked that no doubt high temperatures and high pressures were a difficulty in the way of compounding.

Mr. PILLING thought there had been a great deal of apathy on the part of English makers of gas-engines—the old type of engine having undergone very little modification; and the Continental

makers were certainly giving lessons to the English manufacturers. He suggested the provision of cleaning-plugs and sight-holes for the jacketings, so that deposits could be easily ascertained and cleared away. Mr. Atkinson had spoken of apathy on the part of the public. This could be more properly applied to the makers. Users of gas-engines were waiting for some practical information; and this was what the makers ought to give.

Mr. BICKERTON regretted that the reader of the paper had not gone more deeply into his subject. The Otto cycle engine had, no doubt, been well thrashed out in the Manchester district. But there was another—the Clerk cycle engine—known as the "every stroke engine;" and it seemed to him that the principal developments in the large gas-engines were only a resurrection of this cycle. He would not like to say it was to be the engine of the future. It was a mistake to disparage the Continental engines. Anyone who had seen them must be satisfied that the people who made them knew what was required, and how to meet these requirements. With regard to gas-producer plants, there was no doubt that in these would be found the secret of success for large engines outside the sphere of blast-furnace gas. In his opinion, the gas plant which was to be of any real advantage in this country would have to be one producing gas from bituminous coal. It was not everybody who needed a 1000-horse power plant; and until medium-sized plants—say of from 300 to 500 horse power—were supplied, they must be content to have the small market in large gas-engines which they had at present. With regard to compounding, the system to which the reader of the paper had referred was not quite the compounding an ordinary engineer would expect. The compounding of steam-engines was really done not only for economy, but also to reduce the strain; and until they could compound the gas-engine into each cylinder taking its share of the work, they could not say they were compounding properly. The difficulty was, no doubt, the high temperature; and until some means had been devised by which this could be kept down considerably, he was afraid compounding in gas-engines would not be very successful.

Mr. WATSON said there was some trouble with regard to the handling of large gas-engines, and also as to starting with the load on, which was sometimes required.

Mr. MATTHEWS remarked, with regard to compounding, that they would be able to work with less jacketing. No doubt it was a question of temperature; but if they could get back their temperature by compounding, they might achieve good results.

Mr. WEBB humorously criticized the assertion of the reader of the paper that the English blast-furnace people were asleep with regard to the advantage of utilizing the furnace gas in engines, and the great saving in the cost of production that might be secured. He said this question had for years been discussed at the meetings of the Iron and Steel Institute, but had never been brought before them by English gas-engine makers; it was only the Continental makers who had pressed the question forward. He was quite sure that the blast-furnace proprietors would be most surprised and gratified to hear from the author of the paper that, by using blast-furnace gas-engines, they could reduce the cost of producing iron 8s. per ton.

Mr. GEORGE SAXON questioned the relative economy of the gas-engine as compared with steam for driving a large mill.

The PRESIDENT said it was somewhat of a relief to know that steam-engines were not to be snuffed out just yet. With regard to the statement as to the reduction in the cost of producing iron by the utilization of the furnace gases, he thought this would require some verification before they could accept it. To his mind, the paper had not gone quite so far as many of them would have desired, especially with regard to the large development in gas-engines which was bound to go on in the near future. Undoubtedly there were certain functions which could be better fulfilled by a gas-engine than by steam; but, in mechanics, each type of engine had its own special purpose for which it was the best fitted.

Mr. ATKINSON, in replying upon the discussion, said that, with regard to vertical engines, it would be better if he did not say anything, as he did not wish to criticize competitors. His firm were certainly making a few vertical engines when they were required; but their opinion was that the horizontal was the best. As to fuel-gas producers, he might say that they had plant using slack delivered at about 5s. per ton, which was giving very satisfactory results. With regard to Mond gas, it might probably have to be modified. The question of tar was a serious one, and engines they had made to work with Mond gas were never free from it. He admitted that the Clerk single-cycle engine had many good features. If they were to adhere to the Otto engine, they were almost compelled to develop the bulk of the power in the high-pressure cylinder. With regard to blast-furnace gases, he did not think they were utilized to the extent they might be, and much greater economy could be secured in the production of iron. He did not pretend to say that gas would supplant steam; each engine would have its own special sphere.

The death is announced of Mr. W. H. Norfolk, who some months ago was compelled by the state of his health to retire from the position of Gas Manager to the Leek Urban District Council. In 1872, Mr. Norfolk was appointed Meter Inspector and fitter; and in 1881 he took the position of Manager.

MR. SCOTT-SNELL ON GAS LIGHTING METHODS.

The evidence of the studious interest that Mr. C. Scott-Snell takes in lighting matters has been supplemented by a paper which he has contributed to the proceedings of the Royal Scottish Society of Arts in Edinburgh, and which was read on Monday last week. The name of Mr. Scott-Snell has frequently been before our readers in connection with the ingenious lamp and improvements which bear his name as the inventor. Many of the points in the paper now under notice also deserve the attentive consideration of "JOURNAL" readers.

In the first place, we find the author dealing with the question of street lighting, and strongly advocating the use of large units. Figures were given showing the variation in the light presented to a person walking down a street—in one case, with lights of 540-candle power, and in another with lights of 60-candle power, each arranged so that the minimum light at any point in the street was the same, and did not fall below 1 candle at a yard distance. It was pointed out that the street in the one case with large unit lights would present an appearance of brilliancy, and the other, almost of gloom. We are aware that many readers may come to a different conclusion from the author as to which is the better system to adopt; but it is at any rate noteworthy that Mr. J. W. Bradley, the City Engineer of Westminster, in his report quoted in our last issue, remarks: "Gas and oil would greatly gain as effective highway illuminants if old types of columns and hoods were boldly discarded, and burners grouped to give (say) 700 to 1000 candle power, and placed at the head of 20 to 22 feet columns of modern artistic design." The subject of the most effective method of street lighting is one upon which much controversy may soon occur.

Regarding methods of lighting, Mr. Scott-Snell says: As long as gas is delivered in an unaërated state, so long must supplementary means be used to add air at or near the point of combustion; and the present bunsen burner system is therefore in general service. In this, as is well known, the jet of issuing gas draws air by its injector action into the tube, and combustion ensues at the head of the burner. But right here commences the battle of the systems—a veritable struggle for air.

The 60 to 100 candle power light at ordinary pressure was a gratifying step; and gas, having thereby found its feet once more, after the assumed knock-down blow it received by the advent of electricity, has now commenced to tackle its rival in its very stronghold—large-unit lighting. It early became obvious that increased gas pressure would fulfil in a manner these requirements; and the gas compressor system was installed. In this the gas is delivered under pressure; and in consequence its injector action, or power to suck in more air, is increased. But such a system, says the author, necessarily depends on the contour of the burner for its efficiency in sucking in air. Hence there has followed a crop of patents for the shape of the burner bodies. With different shapes, different pressures gave different results, and consequently we see the existence to-day of compressor systems, varying in their pressure from 9 inches of water column to 15 lbs. per square inch. Each person cries "Eureka," believing some particular pressure of gas to be psychological, oblivious to the fact that the result has to be measured by the issuing velocity and condition of the mixture at the burner-head, not by the initial pressure of the supply; and it is doubtful if there is great variation in the delivery at the head in the various systems, in spite of the enormous difference in supply pressure.

As the conditions of the struggle became better understood, they practically crystallized into the following: The air delivered with the gas must bear such a *proportion* to the gas as to ensure perfection of combustion. The *velocity* of the combined mixture must be such as to ensure a certain number of thermal units being brought into contact with a mantle of given size in a given period of time. The desirable velocity may have to be modified to suit the fragile nature of the mantle, in order to ensure reasonable life. Under these circumstances, it appears to the author that the highest attainable efficiency can best be assured by arranging the two elements of combustion—gas and air—in separate circuits, each under separate control, so that: (1) The correct *proportions* of air and gas can be obtained by adjustment. (2) The correct *volume* of such mixture can be controlled and supplied to suit a particular size of mantle.

The adjustability of the Scott-Snell system was shown at the meeting by a lamp, in which the rotation of the burner gave any required adjustment of the gas supply, while an air-screen enabled such control of the air delivery to be made as to ensure the greatest illumination in the mantle. The lamp illustrated, without any change in construction, was therefore capable of being adapted to give anything from 400 to 750 candle power. In this system, it is, of course, obvious that the extra gas burned, by its waste heat, is capable of generating the necessary air. The air pressure delivered by the lamp was equal to a water column of about 30 inches; and we are informed by Mr. Scott-Snell that recent tests, which can only be carried out in very rough weather, have demonstrated that a new system of ventilating which he has adopted makes the lamp practically hurricane proof.

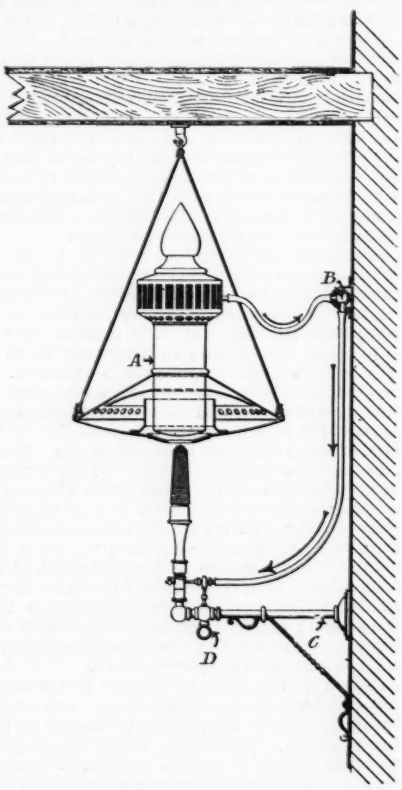
A new type of anti-vibrator was also shown at the meeting, in which the head of the burner is entirely disassociated from the

tube, and floats in a mercury bath, so that a perfect gas-tight seal exists, while no vibration passes. This has been tested, the author states, in a position where the vibration, owing to circumstances beyond his control, was so excessive as to cause the use of one mantle per day, where afterwards only one every three weeks proved necessary.

Particulars were given in the paper of trials of the Scott-Snell lamp, made quite away from, and so independent of, the author's control. These are as follows:—

—	Consumption of Gas per Hour.	Candle Power.	Candle Power per Cubic Foot of Gas.
Consolidated Gas Company (New York)	13½	572	42·0
People's Gas Light Company (Chicago)	13	548	42·1
Long Branch Company (Long Branch, N.J.)	13·06	562	43·1
New Amsterdam Gas Company (Ravenswood, L.I.)	12·9	544	42·1

In referring to other systems, Mr. Scott-Snell remarks: The compressor arrangement has already been dealt with. It is not suitable for street lighting, on account of the special circuit which must be laid for it; and the efficiency at a pressure of 9 inches is, I believe, about 30 candles per foot. It is useful, however, for isolated installations; and therein finds most applications. Induced draught lamps—so called self-intensifying—are now becoming numerous. The latest to enter this field is that produced by



Messrs. Falk, Stadelmann, and Co.; and, from their price list, I find their figures are 23 cubic feet for 500-candle power or (say) 22-candle power per foot, which they declare is somewhat below the real duty. This is probable, as I see their rival, the "Lucas" lamp, when tested by the City Lighting Department of Paris, showed about 26 candles per foot, which I find approximates to figures obtained in tests, made by myself on similar types of lamps in this country.

Another type of lamp which has recently made its appearance is the regenerative incandescent, in which the air is heated before combustion. This might easily be arranged for in the Scott-Snell system, if experience proved it sufficiently advantageous. A more important matter for the latter system is its introduction in the form of a master lamp feeding compressed air to smaller units, whereby the high efficiency of the master lamp is ensured in the satellites. This is not as yet tested to its full limit; but it is designed to permit of a master lamp or lamps lighting the outside of shop windows also being made to supply air by a special flexible air circuit to smaller lamps within the shop. By this means, a No. 0 Kern burner may be arranged to give nearly 100-candle power. Another important application now being handled lies in the Lighthouses and Port Lights, the intrinsic intensity of the mantle being such that a large volume of light is practically within the focus.

We illustrate an application of the Scott-Snell system which has an element of novelty. In this skeleton lamps or "generators" A are suspended over the more powerful lights, and deliver compressed air to a common feeder pipe B, from which they draw by flexible tubes air for their own needs, and the surplus is used in other smaller units by the coupling up of the combination air and gas nipples provided to the main air-feeder pipe. The whole system is then run on the high economy lines which are obtainable where the facility for air and gas adjustment prevails. There is no rigid mechanical connection between the lamps and generators, the existing gas-service C is retained, and the gas pressure is, of course, normal; while, if wished, the lamps may be run as ordinary low-pressure lights by turning the combination cocks D into a certain position. Thus "police lights" may be left running all night, or, when only a small light is needed for any purpose, it can be at once obtained.

The simplicity of the so-called "generators" or lamp bodies is perhaps best expressed in the author's description: "As an engine or machine it is remarkable, inasmuch as the diaphragm is the equivalent of, or at any rate admits the banishment of, any driving cylinder, crank-shaft, air-pump, fly-wheel connecting-rod, and such-like accessories, which are usually involved in the attainment of compressed air from a heat-actuated motor." A diagram of the Litle lamp, which is being introduced in America, and which involves all the aforesaid accessories, was shown by the author.

Perhaps we cannot better conclude this, in large part, digest of the paper than by quoting the following extract which may be commended to ratepayers generally, and perhaps Marylebone in particular: "The increasing efficiency of gas lighting well deserves attention from the community generally. The tendency for municipalities to rush into costly installations of electric light being largely due to ignorance of the means which now exist for obtaining very effective lighting from the already laid gas-main. There will, of course, be adherents to each system quite unconvinceable by argument; so that it seems inevitable that the open war of practical competition must be called upon to settle the relative merits of the rivals. It is a pity, however, that the 'butcher's' bill must be heavy; and many boroughs find themselves saddled with a needless expenditure in laying down new plant where the old system was quite capable of meeting all requirements. The installation of any rival illuminant cannot be an advantage to a community if the existing system is really perfectly capable of meeting all requirements, and if the officials of the system in possession will do their duty as thoroughly under monopoly as they would in the face of keen competition." This last is an important point.

TESTS OF MANTLES, GLOBES, AND CHIMNEYS.

In a recent number of the "Technology Quarterly," of Boston, Mr. W. Lincoln Smith gave the results of some tests he had made of mantles, globes, and chimneys for incandescent gas-burners. He used for his purpose a Weber portable photometer and a König spectro-photometer. The gas supply was taken from the street mains, and measured by a 3-light meter. He examined ten types of mantles; and finally chose three for complete study—viz., the "Yusea," the "Majestic," and the "Admiral." They were all purchased of retail dealers, without any suggestion being made as to the use to be made of them; and six of each were tested—the results recorded being in each case the mean of the specimens. In order to locate the mantle properly at first, Mr. Smith adjusted the burner for the maximum candle power as shown on the photometer, and then turned the burner on the pipe until the highest possible reading was given. Then by means of a lens he projected an image of the mantle on a sheet of cardboard, tacked on the wall behind the photometer, and drew out with ink the outline of a large section of the mesh as it appeared in the image. When a second mantle of similar type was to be used, it was placed on the burner and turned so that the image of its mesh coincided as nearly as might be with that lined out upon the cardboard. With a given type of mantle, tests were first made to determine the change in candle power for different rates of consumption of gas; then the mean of the six sets was determined, and the two mantles which came nearest to this mean were selected for further examination. These two were then compared with the spectro-photometer at fifteen equidistant points; and if the ratio between the two mantles appeared irregular, another mantle was also compared. Two mantles as nearly similar as might be having been found, they were put aside for further study. The Weber photometer was used, with a small incandescent lamp as a secondary standard. The results obtained with the spectro-photometer were purely relative; the figures obtained being invariably a ratio between the light under test and a specified standard.

The results of Mr. Smith's observations are all plotted out in a number of diagrams, for which we must refer those of our readers who are specially interested in them to the publication already named, or to "Progressive Age" for the 16th ult., in which they have been reproduced. It is recorded that all the mantles showed an increasing tendency with age to clog up with soot—some more rapidly than others. In the matter of handling (which, of course, is deleterious in the extreme after the mantle is once lighted), the "Yusea" and the "Admiral" seemed by far

the most durable. Again, the matter of warping is an important point; and here the "Yusea" and "Majestic" led, with the "Admiral" a good third. The flame invariably passed through a very sensitive state; so much so that frequently a sharp snap of the thumb and finger, or a sneeze across the room, would nearly or completely extinguish the light. This point occurred invariably when about three-quarters of the way up towards maximum brilliancy, which was reached shortly after the sensitiveness had fallen off; while about an equal distance beyond the maximum on the descent occurred the "whistling point," where the gas began to make a noticeable noise as it passed the burner. The examination thus far seemed to show that the choice lay between the three mantles already named.

It is well known that mantles, though they may give a very white light at first, immediately begin to change in colour—some more rapidly than others—in the direction of a sickly greenish hue, which is exceedingly disagreeable; the majority tending towards a hue on the blue side of green, but some towards one on the yellow side. The only way of telling what and how great change takes place is to study the mantle throughout a lengthy period with the spectro-photometer. The plan followed was to take two matched mantles, and having chosen one as a standard, to place it in position and adjust the burner and cocks in the piping so that, after having warmed up, it consumed gas at the proper rate. This mantle was burned as little as possible—in all, a total of less than four hours. The other, or test, mantle was put in position and burned steadily for 200 hours. It was compared with the standard after having burned 5, 10, 20, 40, 50, 80, 100, 120, 140, 160, 180, and 200 hours. At these times it was also tested for candle power at the rate of gas consumption which the previous test had shown to give the maximum light, and at the end of the 200 hours it was again examined for candle power with changing gas consumption, for comparison with the measurements made when new.

The maximum light yielded by the "Yusea" mantles was 70 candles, dropping to 55; the "Majestic" gave 63 candles, and fell to 40; and the "Admiral," 58, falling to 39. The maxima were obtained with consumptions ranging from 3 to 4 cubic feet of gas per hour; the finals with rather more than 6 cubic feet. The tests for changing colour in use showed in the case of each mantle a point in the yellow or orange where the curves intersected, though this was much more marked in the "Majestic" and the "Admiral" than in the "Yusea," which displayed a tendency to a yellowish green, while the other two tended towards a bluish green. The outcome of Mr. Smith's labour was the selection of the last-named mantle as the best for use in important places.

The author emphasizes the point that a mantle, of whatever style, should not be used without some pattern of diffusing shade; and this, or the chimney inside it, ought to be tinted, so as to correct, as far as possible, for the peculiar hue of the light—changing it over either to a fairly good white or to the more general hue of artificial illuminants employed for interiors. He made a selection of nine egg-shaped open-ended globes, as follows: Prismatic glass, with vertical inner ribs; white "Holophane" glass; pink do.; robin's egg blue fluted opal glass, pale green do.; orange yellow do.; rose pink do.; ruby fluted frosted glass; white fluted opal glass. He also selected six chimneys made respectively of thin greenish-blue glass, amber glass, rather thick white opal glass, and dark green, red, and blue glass. None of these would, however, be of value except for producing colour effects in advertising, &c.; but Mr. Smith thought it would be interesting to see what their use meant in waste of light. In these experiments he employed as a standard a Nernst lamp fitted with a thin globe of frosted glass for diffusion. The following table of tests of globes gives the candle powers found by the Weber photometer, and hence a measure of the light lost; but it should be understood that since the candle power given is horizontal, and not the mean spherical, the two holophanes cannot be directly compared with the others, since these two differ widely from the others in their action on the light.

	Horizontal Candle Power.		Loss Per Cent.
Naked mantle	81·80	..	—
Prismatic glass	65·80	..	19.6
White "Holophane"	70·30	..	14·1
Pink "	64·30	..	20·8
Robin's egg blue fluted opal	22·90	..	72·2
Pale green opal	18·30	..	77·8
Yellow opal	33·00	..	59·7
Rose pink opal	19·90	..	75·6
Ruby frosted	28·50	..	65·2
White opal	38·30	..	53·2

The following table contains the results of the tests of coloured chimneys:—

	Candle Power.		Loss Per Cent.
Naked mantle	81 80	..	—
Thin greenish blue	37·50	..	54·2
Amber	71·30	..	12·8
White opal	51·80	..	36·7
Dark green	4·90	..	92·8
Dark red	22·70	..	72·3
Dark blue	0·35	..	99·6

CALORIMETRY OF GASEOUS AND LIQUID FUELS.

By W. Garnet Wernham.

[Extracts from a Paper read before the Junior Institution of Engineers.*]

The importance of being able to determine with ease and accuracy the calorific or heating value of fuels, particularly gaseous, has been greatly emphasized the last year or two, more particularly during the progress through Parliament of certain Bills giving power to corporations to manufacture and supply gas at a low price to be used for purposes which require it to possess, not a high illuminating power, but as high a calorific power as is consistent with the low price charged. Such gas is usually so deficient in hydrocarbons as to render it useless for lighting purposes; but as a heating agent and for motors it has a wide field, as, though its calorific power may be much lower than that of illuminating gas, the reduction in price is far greater in proportion. The South Staffordshire Mond Gas Company is a typical instance of a Company manufacturing gas for power and heating purposes only. The case of an ordinary gas undertaking is somewhat different. Although a large proportion—in many instances the major portion—of the gas supplied is used for heating, either in stoves, water-heaters, or incandescent burners, or for power, they still have to supply a quantity of gas for use in ordinary flat-flame or argand burners; and, moreover, their Acts of Parliament require that gas of a certain illuminating power shall be supplied. The late Mr. Bryan Donkin made a suggestion that gas companies should lay two sets of mains, and supply gas of different qualities—one of low illuminating power at a cheap rate, for heating and power, and one of sufficient illuminating power to meet the requirements of consumers using ordinary burners, and fulfil the conditions of their Act. That the consumer would benefit is at once apparent. At the present time he is using gas of (say) 600 B.T.U. per cubic foot in his stoves and engines, at a cost of, we will say, 3s. per 1000 cubic feet. For a tenth of this sum he could obtain gas of 150 B.T.U., or one-fourth its present value. By a simple arithmetical calculation, it is seen that for the same amount of work from his stoves or engines he would reduce his gas bill by 60 per cent.

The foregoing remarks will make it quite clear that if power gas is to be supplied to so large an extent as is contemplated, some radical changes will be necessary in the conditions which govern the sale. The gas will, of course, still be sold by the same method of measurement as ordinary illuminating gas—*i.e.*, at so much per 1000 cubic feet—although it is probable that some different form of meter will have to be devised for measuring such large quantities as will be used, and which will be more compact than the present wet or dry meter of large capacity.

The existing regulations, however, as to testing gas supplied for illuminating power and the presence of impurities under the Gas-Works Clauses Act and other Special Acts, are obviously useless in the case of gas which possesses practically no illuminating power. The object being to produce a gas for heating and power purposes, and therefore of a sufficient calorific value, the consumer must have some means of knowing that the gas he is buying is of the stipulated power. There are two methods of doing this—one being by analysis, and the other the direct calorimetric test by actual combustion. By the first of these, a complete analysis is made of the fuel to be tested. Then the sum of the products of the various constituents, multiplied by their known heat values, will equal the total gross heating value of the complete gas. A test such as this cannot be attempted by anyone not possessed of considerable skill in gas analysis; but where this is available, the analytical test, when carefully carried out, is of great value in checking the results obtained by the calorimeter. The alternative method is to determine the heating value of the gas directly, by measuring the heat imparted to a known quantity of water by the combustion of a measured volume of the fuel in a calorimeter.

It may be interesting to give some notes on the development of the modern form of gaseous fuel calorimeter from the earlier types. Rumford appears to have been the first to devise a practical form of calorimeter for gaseous fuels. In 1814, he is credited with constructing an apparatus consisting of a copper boiler containing water, heated by the fuel under test, which was consumed in a burner placed underneath the boiler. Air for supporting the combustion of the fuel was supplied from a jacket surrounding the boiler, and the products of combustion passed away through a tube immersed in the water; the calorific value being calculated from the rise in temperature of the latter. It is worthy of note that Rumford, by surrounding the heated vessel with a jacket consisting of air which was afterwards used to support the combustion of the fuel, employed a most economical method of preventing loss of heat by radiation, inasmuch as any heat imparted to the air-jacket would tend to increase the flame heat, which would not be the case if a non-conducting material were used for jacketing.

Fabre and Silbermann subsequently devised a calorimeter

* The paper was briefly noticed in the "Journal" for the 17th ult., (p. 413).—Ed. J.G.L.

which formed the basis of a great many different types of calorimeters, which, though varying in detail, all possess the chief characteristics of the original instrument mentioned above. It consisted of a combustion chamber which was surrounded by a copper vessel containing a known quantity of water. The fuel was consumed in the chamber, oxygen being introduced to support combustion, and the waste gases passed away through a coiled tube; the result being calculated from the rise in temperature of the water in the containing vessel. There are various modifications of this type of calorimeter, chief among them being those of Carpenter, Fischer, Alexejew, Barrus, and Schwackhöfer. In these calorimeters combustion takes place at atmospheric pressure. In the calorimeters of Berthelot and Mahler, the fuel (if gaseous) is drawn into the combustion chamber, which is previously exhausted until it is below atmospheric pressure, and oxygen, compressed to several atmospheres, is introduced. Combustion therefore takes place in an excess of oxygen, the combustion chamber, or "bomb" as it is called, being strongly made to resist internal pressure.

All the above-mentioned calorimeters have drawbacks which render them unsuitable for use outside the laboratory and in the hands of operators not possessed of considerable experience in handling apparatus of this description. Moreover, compressed oxygen has to be used; and M. Berthelot recently stated that ordinary commercial oxygen, such as is sold in cylinders, contains sufficient impurities (chiefly hydrogen) to cause an error of 0·02 to 0·03 per cent. in the observed results. The gases, too, are burnt under conditions which do not exist in actual practice; and though combustion in an excess of oxygen should be most perfect, yet it is, in the author's opinion, desirable to test the fuel under its ordinary working conditions.

The first radical step in this direction was made by Hartley, who in 1884 produced before the British Association of Gas Managers a gaseous fuel calorimeter in which the gas was burnt in a bunsen burner under ordinary conditions; the calorific value being calculated from the heat imparted to a certain quantity of flowing water by a measured amount of the fuel.* The results obtained with this apparatus were very accurate, as the calorific value of pure hydrogen estimated by it agreed very closely with the determination of eminent scientists.

Hugo Junkers next brought out a calorimeter which in principle is similar to Hartley's, but differs in several details. It consists of a combustion chamber surrounded by a water-jacket, passing vertically through which are a number of tubes open at both ends. Surrounding this jacket is another containing the heated water, and communicating with the dome and finally with the outlet funnel. The water, after passing through the inlet funnel, provided with an overflow which is intended to keep the head of water constant, flows through a regulating cock, and over the bulb of the inlet thermometer. Thence it circulates round the vertical tubes before mentioned, and becoming heated by the products of combustion, rises and flows past a series of baffle-plates and an outlet thermometer to the outlet funnel. From here it is conveyed by a piece of flexible rubber tube either to a measuring flask or to waste; the tubing being manipulated by hand. The gas is burnt in the bunsen burner (after being measured and governed), and the heated products of combustion, rising up the combustion chamber, are deflected at the top, and fall through the vertical tubes—the latter communicating their heat to the water circulating round them. The products issue through a large tube, provided with a regulating valve—any condensed water being led away by a tube, and collected and measured; the figure thus obtained enabling a correction to be made for the latent heat of steam generated during the combustion of the fuel. This calorimeter is largely used in this country and in America, chiefly because, until quite recently, it was the only practical instrument on the market by which a quick and simple test could be made. The Dowson calorimeter, designed by Mr. Emerson Dowson, is similar in principle to that of Junkers, the chief difference lying in the arrangement of the tubes.

The Simmance and Abady calorimeter is one of the most recent introductions of instruments of the Hartley type. Based upon the same principles as Hartley's calorimeter, it differs from the Junkers and Dowson types in that the products of combustion, instead of descending through tubes of small area, pass down through the annular spaces between cylinders placed concentrically containing the water to be heated. This large outlet area is extremely useful when testing gas of low calorific value which requires the combustion of a large volume to produce a moderate heat.† The method of making a test is practically the same as for Hartley's instrument. The quantity of gas consumed is, however, smaller; being usually about 0·1 instead of 0·25 cubic foot. This is because the possibility of error while making a short test is very much less than on a long one; and the reading being a "flying" one, no loss is occasioned. The regulating valve and thermometer on the products outlet tube is an important feature in this calorimeter. The valve should be so regulated that the products issue at 60° Fahr.; thus ensuring that all the heat has been extracted from the gas. Having all the necessary data, the result of the test can be calculated. The following formula will give the value in calories per cubic foot of the gas consumed:—

$$\left(\frac{W}{G}\right) = T$$

Where W = amount of water collected in cubic centimetres.
G = quantity of gas burnt in cubic feet.
T = difference between inlet and outlet thermometer.

The above amount is the full, or "gross," heating value of the gas. In order to arrive at the "net" result, we must deduct the amount of heat imparted to the instrument by the condensation of the water vapour formed during combustion. The net result is really of rather more academic than practical interest, because in practice this water vapour can be utilized for heating purposes. For example, in a condensing stove, and even in an ordinary incandescent burner or heating stove, the products impart their heat to the atmosphere. It is therefore hardly fair to thus handicap the gas by deducting from its value a proportion which can be used in properly constructed apparatus. However, as it may be desired to know the net value, the method of arriving at it is here described. The quantity of water condensed during the passage of the known amount of gas is collected in the small measure. The latent heat of steam is usually taken at about 540°C. —*i.e.*, 540 calories are required to raise 1 kilo. of water from boiling-point to steam. Therefore to reduce this steam to water (15° atmospheric temperature) an additional 85° must be added to the figure. Supposing the amount collected during the combustion of 0·1 cubic foot to be 3 c.c., then 3-1000ths (0·003) kilo. has been raised 625° (540° + 85°), and 625° × 0·003 = 1·875 calories have been absorbed. This figure multiplied by 10 (18·75) must be deducted from the gross heating value per cubic foot of the gas burnt.

The rapidly increasing use of oil fuels for heating purposes and for internal-combustion engines renders it extremely desirable that a quick and simple test of their calorific value should be possible. Estimation of the heating value of oils by the analytical method is somewhat misleading, owing to the complex nature of their constituents. It is found that the calorific value obtained by the method of multiplying the constituents by their heat values is much higher than that developed by combustion. The two chief constituents, carbon and hydrogen, being present in the form of several different compounds, it is probably incorrect to take the ultimate analysis as a basis for calculation. It is quite possible, however, to determine the calorific values of oils in the bomb calorimeter, and also in an instrument such as that last described. The latter method is comparatively simple, and consists in burning the oil in the combustion chamber of the calorimeter, either vaporizing and consuming it in a specially constructed burner, or burning in a lamp, depending upon the nature of the oil. Very volatile oils are, of course, best vaporized, as they are unsuitable for burning in an ordinary lamp. [The author described a convenient method of testing ordinary burning oils.]

With the rapid increase of powers granted for the manufacture and sale of heating and power gas, it is almost certain—and, indeed, imperative—that some means of standardizing the instruments used for calorimetric tests should be arrived at; otherwise endless disputes, the results of conflicting tests on different instruments, will be the outcome. It is probable that this matter will, as is the standardizing of instruments for testing the quality and illuminating value of gas, be put into the hands of the Standards Department of the Board of Trade or the National Physical Laboratory. It is therefore worth while to consider how this standardization may be effected. Not alone by the exact measurement of the various parts, though this will probably be essential. The only practical method appears to be the testing of a gas the calorific value of which is known absolutely. The calorific value indicated by the calorimeter compared with its known value would give the measure of the efficiency of the instrument, and for each one a constant could be given with which to correct its readings, as is done with standard thermometers and barometers. The gas which at once suggests itself for such a purpose is hydrogen, the calorific value of which has been determined by many scientists. This is a gas which is capable of consumption in a burner (not atmospheric) under the same conditions as ordinary gas. One problem which the use of hydrogen presents is the difficulty of producing absolutely pure gas on a commercial scale; but this may be overcome in the near future.

Meanwhile, there is an alternative method to hand. Pentane is an extremely light petroleum spirit, having a specific gravity of ·625, and gasifying without residue at atmospheric temperature. It is capable of being produced in large quantities, of an unvarying composition, with great exactitude. Owing to these qualities, it is now being used almost universally in standards of light, in which it is converted into air gas, and burnt in this form. Naturally, in a standard of light the quality and composition of such gas must be invariable; and it is found that pentane air gas possesses this property. Here, then, we have a gas which appears to completely fulfil our requirements. It is of unvarying composition at normal temperatures, and can be produced cheaply, with ease, and in large quantities. The method used by Mr. Vernon Harcourt, who was largely responsible for the development of the pentane air-gas standard, was to introduce a measured quantity of the liquid pentane into the bell of a gas-holder containing a known quantity of air. The pentane, on

* See "JOURNAL" for June 17, 1884, p. 1073. The author gave a description of this instrument, and explained the method of making a test with it.

† The author explained the construction of the apparatus, which was described in the "JOURNAL" for June 25, 1901 (p. 1751).

vaporizing forms a gas resembling rich coal gas, and possessing a certain calorific value which can be adjusted by the introduction of more or less pentane, and can be calculated from its constituents. It remains to be seen what steps will be taken in regard to this question of standardization. That already some interest is being displayed in the matter is shown by the introduction in a recent Power Gas Bill of a clause determining the temperature at which the products of combustion are to issue from the calorimeter; and that further regulations will follow is inevitable.

While on this subject, the author would like to make a plea for standardization, or at any rate for some uniformity, in the manner of expressing the calorific values of fuels. At present we have the two fundamental heat units—the British thermal unit and the French calorie (which represents the heat required to raise 1 kilo of water 1° C. These are used in connection with the units of measurement in the most confusing manner; some authors expressing their results in "pound-degrees per cubic foot," or "Centigrade heat units," "gramme-calories," "B.T.U. per metre," and "calories per cubic foot." It appears to be entirely unnecessary to mix up the English and metric terms in this way. If we desire to keep to English measurement, let us express our results in British thermal units per cubic foot or pound; but if not, at any rate let us be consistent, and express the metric calorie in terms of a metric unit.

IN THE "DURA" MANTLE FACTORY.

In discussing recently the position of the incandescent fittings and mantle trader, and the beclouding of his outlook by the threatened temporary shortage of thorium in the circumstances then explained, it was mentioned that it was abundantly manifest the tranquillity of mantle makers was only receiving passing disturbance, seeing that on every hand they are making provision for extended output. This is a happy sign. Among the makers who have been considerably enlarging their power of production are the Guaranty Incandescent Mantle Company, Limited; and yet they have a scheme for still greater things in view—having made provision of the necessary land space for a large new factory adjoining their present premises at Streatham. We have not visited these works since first they were started; but considerable extensions having been made, an opportunity was taken a few days since of inspecting, accompanied by the Managing-Director (Mr. E. A. F. Schultze), the enlarged capabilities of the factory.

In mantle making as in other things, practice and experience bring improvement not only in the articles themselves, but in the expedition with which they are produced; and moreover—and this we regard with pleasure—as mantle making is essentially a feminine occupation—an increasing solicitude for the welfare of the employees, in respect of comfort, healthfulness of surroundings, and safety, is apparent as the factories are visited from time to time. This is so in the case of the Guaranty Company's factory. There can be little danger here from fire. The premises are divided into a number of separate structures, all of them being ground floor, with swing doors. The ventilation of the premises, too, has received special consideration, and is about as perfect as it could be—ventilation being of the utmost importance to the girls working in the burning and seasoning and colodionizing and drying rooms. The capacity of the factory, working ordinary time, is now about 140,000 a week (just at the present, the output is about 110,000); but when the burning and seasoning are performed by electrically worked machines, instead of by hand machines, the existing buildings will be equal to a production of at least 170,000 a week.

The processes through which the "Dura" mantles pass in development are, of course, similar in every respect to those which we have recently described. But it is of interest to note a remark that Mr. Schultze made in the course of conversation—to the effect that, in his opinion, the mantle manufacturer of this country can do exactly, and even better than, what the mantle manufacturer of Germany can do; and there is no question in his mind about the superiority of the labour here. He finds that the English girls soon get very deft at the work; and, with fair treatment, they take a keen interest in it. At the present time, with the office staff, there are on the premises some 220 to 230 employees. Before the fire (which, it will be remembered, unfortunately took place just about the time of the incandescent mantle settlement), the Company were employing about 90 girls. The increase since, and the fact that in the prospective erection of permanent buildings provision is contemplated for the employment of between 600 and 700 hands, are further indications of the progress of the incandescent mantle business. When this further extension is made, it is also intended to transfer the work of knitting the fabrics to Streatham, so as to have the whole of the operations under one management and supervision.

We will take a hasty glance round the factory. After passing through the rooms in which are conducted the first processes—the impregnation with the lighting fluid, the sewing, and the fixing of the mantle tops—we come to the first burning and each seasoning room; and in this are seen eighteen hand machines each burning-off and seasoning twelve mantles at a time, and having a capacity for dealing with 600 or so a day. In the new portion of the buildings, there is another burning-off and seasoning room, in which are installed 16 frames, or two less than in the older room. Here also we find a new electrically worked machine, which only requires a very modest amount of attention on the part of the girls in charge; and it has the economical advantage of being able to do the work more rapidly, and yet ensuring the thoroughness and regularity that are needed to produce uniformity in production. This machine is one of Mr. Schultze's ideas; and it is his intention to apply it throughout the works—thus increasing the power of production on the same ground space. The gas is supplied to the burners in the frames at the high pressure of 38 inches. The gas compressor used is an American invention, operated by a small electric motor; and it can be worked to an enormous pressure, and regulated (Mr. Schultze tells us) to almost sixtieths of an inch.

In the old burning off and seasoning rooms, the arrangements for ventilation are about as well devised as they could be. The whole of the frames are situated beneath a large sheet-iron hood (with an asbestos outer coating). From the top of the hood leads a shaft, at the inlet to which is a fan for drawing from the hood the fumes and heated air. This room is as perfectly ventilated as any we have seen in which similar operations are conducted. The several ventilating-fans throughout the place are worked by electricity, and the lighting is also done by the same means—the Company possessing their own private electricity generating plant, which is driven by a 9-horse power Crossley gas-engine, with a 4-horse power one in reserve. In the burning and seasoning room in the new portion of the premises, a fresh method of ventilation has been tried; but its efficiency is not so good as in the older room, and a large hood and shaft with its suction fan will soon be installed there, to the great benefit of the employees. From the old seasoning-room, the mantles are passed through chambers in the walls to the collodionizing-room where they receive their final treatment, and are dried in a specially constructed chest which is capable of containing about 64 gross of mantles. Very special precautions have been taken in this room for the rapid ingress of fresh air and egress of the hot air and fumes. This room also deals with the mantles from the new seasoning-room some 140 feet away—the mantles being transferred to it by means of a lorry and long overground duct. The stamping, packing, and other rooms all contain their interesting features, but need not be specially mentioned.

Altogether about fifty different varieties of mantles are made at this factory, for burners of all kinds—both high and low pressure. The Guaranty Company besides this make the well-known "Dura" mantle; also producing the special mantles of some half-dozen other firms. Strange to say, some of their customers are in Germany. The Company are now manufacturing a large portion of their mantles of three-ply ramie; and some examples were shown in use which, by the dated labels attached, had been burning for 1600 hours, and were still in a splendid condition. Not one showed sign of fracture; their form was beyond reproach; and the illuminating results were excellent. So satisfied are the Company with their experience of these mantles, that they are proposing to discontinue as soon as possible the use of a cotton base. Many gas companies, they inform us, now stipulate for mantles made with the ramie base, on account of their superiority in point of strength. The considerable extension of the Company's premises, and the great improvements effected in the old portion, are proof of their progress; and upon this progress they are to be heartily congratulated.

Manchester District Institution of Gas Engineers.—As already announced, the members of the Institution will hold their annual meeting at Manchester next Saturday. The *agenda* promises an interesting afternoon. There will be the Inaugural Address of the new President (Mr. S. R. Ogden, of Blackburn), who succeeds Mr. Arthur Graham in the chair. This will be followed by two papers. Mr. Henry Fowler, of Derby, will read his "Notes on Working with an Illumination Photometer"; this being the paper that was, through pressure of business, postponed from the last meeting. The title of the second paper "Tar Fog," also looks as though the author—Mr. W. Everitt, of Ilkley—has something attractive in store. The remainder of the time set apart for business will be devoted to formal matters; and early in the evening tea will be provided.

"The Electrician" Electrical Trades Directory.—We have received from "The Electrician" Printing and Publishing Company the above-named work for the present year. The issue of the book has been delayed for a short time, to allow of the inclusion of the new wiring rules of the Institution of Electrical Engineers and other matters. Many additions have been made to the "Handbook" section of the Directory, among them being the new German electric wiring rules and regulations, the parliamentary record for the past year, the purchase prices of electricity supply undertakings, &c. The tables and other usual features of the book have been brought up to the 10th ult.; and there are two new ones showing the areas comprised in electric power schemes and the extent of locomotion in London. Every effort has been made to render the "Directory" section accurate. Altogether, the twenty-first issue of what is familiarly known as the "Big Blue Book" may be commended to the attention of our readers for containing a mass of information on subjects in which they are largely interested.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Parliamentary Agents' Commissions to Town Clerks.

SIR,—My attention has just been drawn to the articles and correspondence on this subject contained in your issues for the 10th, 17th, and 24th inst.; and I desire to point out that, though I should not now like to be absolutely certain of the exact words of which I made use at the Society of Arts, it was not my intention to suggest that the Association of Municipal Corporations was "instituted" by a firm of Parliamentary Agents who allowed commissions. As a matter of fact, I had at that time no idea as to who instituted the Association; and what was in my mind to suggest was that the Association, as also the District Council's Association, were "engineered" by certain firms of Parliamentary Agents who allowed these commissions. This is what I am credited with having said in the official report of the Society of Arts, published in their "Journal;" and, having regard to the facts, this is a statement which I think I was fully justified in making.

66, *Victoria Street, S.W., Feb.* 26, 1903. A. A. CAMPBELL-SWINTON.

[Reference has been made to the shorthand notes taken at the meeting of the Society of Arts, and the word "instituted" appears twice in the allusions to the Associations mentioned in the report of the speech. Comparison of the reports in the "JOURNAL" with that appearing in the "Journal of the Society of Arts" will show that, at this particular point, the one in the latter has been somewhat abridged. However, our correspondent is entitled to his preference for the word "engineered;" but we do not at all like it in such a connection as the present.—ED. J.G.L.]

"Why Milwaukee did not Build Inclines."

SIR,—Mr. Herring's criticism (as reprinted in your "JOURNAL" of Jan. 27) of my remarks at the New York meeting of the American Gaslight Association, on the subject of "Inclines," seems to me a little wide of the mark; and if I am so "lamentably wrong," and my "conclusions fallacious," I trust Mr. Herring will show me, in detail, my error. He certainly has not done so in the letter referred to.

The point I wished to make, when discussing the question at the meeting, was this: Judging from the facts and figures in "Field's Analysis" from year to year, the results in Edinburgh have been, in some important respects, so far below those of many other companies, that almost any change of methods should have produced a better showing than was being made there in carbonization, and that the improvements claimed to have been effected should not all be credited to "inclines"—that very probably a change to any other modern method may have given as good, or even better, results.

Mr. Herring says: "I would like to ask what possible bearing the cost of coal and the returns for residual products can have upon the cost of charging coal into the retorts, and drawing the resulting coke therefrom." The bearing is this: So far, it has been almost impossible to compare the statements given out where different methods are in use, because the information given is not always on the same basis. Consequently, while each statement may be strictly true, it may sometimes be as misleading as a positively incorrect one. Surely Mr. Herring does not wish the gas world to infer that there is a difference in the cost of coal in Edinburgh and Glasgow between $1·30 and $6 (say, 5s. 6d. and 25s.)? If not, why does the gentleman bring in such an illustration to combat my comparisons between Edinburgh and Glasgow? I cited Glasgow because it seemed that the cities both being large, at no great distance apart, the cost of coal and labour should not be greatly different; and if Mr. Herring will show in detail wherein the comparison is unfair or inapplicable, I shall be glad. Mere assertion is not sufficiently convincing.

The following figures from "Field's Analysis" for 1901 will, I think, demonstrate where the fallacy rests:—

	Edinburgh, d.		Glasgow, d.
Cost of coal and oil, per 1000 cubic feet made	21·46	..	23·35
Less residuals	5·73	..	8·26
	15·73	..	15·09
Salaries	0·27	..	0·19
Wages	6·22	..	3·81
Purifying	0·75	..	1·41
Wear and tear	2·47	..	2·63
	25·44	..	23·13
Coke used for fuel, per ton of coal	6·13 cwt.	..	2·64 cwt.
Ditto, percentage on make	56	..	25
Coke for sale per ton of coal	4·83 cwt.	..	7·89 cwt.

Surely any change in Edinburgh methods should change results for the better. The above figures speak for themselves; and I think they justify the position I took—that, with such figures as the above before us, it seemed safer to eliminate Edinburgh from the discussion. And it still seems so to me. The comparisons of Edinburgh for 1900 are still more unfavourable to that city than those for 1901, notwithstanding that in the latter year the quantity of coke made for sale was far lower, and the fuel account far higher, than any other out of nineteen of the thirty-four other companies reported in "Field's Analysis." The coke for sale per ton of coal was less than half that of seven other companies, and the fuel account double; or more than double that of any one of nineteen companies. Are these fallacies? If so, "Field's Analysis" should be amended. In the meantime, I rely on "Field."

The points I raise seem to me to have a very important bearing on the relative values of carbonizing methods, which, after all, must be judged by final results. But fancy, in 1900 (the beginning of the 20th Century) 61 per cent. of coke made in Edinburgh used for fuel, against 22 per cent. and lower in Glasgow and other places. Is this also a fallacy?

Syracuse, N.Y., U.S.A., Feb. 9, 1903. T. LITTLEHALES.

Mr. Glasgow and the Lowe System.

SIR,—Referring to the reply in last Tuesday's "JOURNAL," by Mr. C. Dellwik to the article by Mr. A. G. Glasgow on the above subject, I do not consider either the original article or the reply thereto has added anything whatever to the general store of knowledge bearing on the matter in dispute.

The question of coke consumption at Manchester or any other town, per 1000 cubic feet of carburetted water gas made, is not to the point; nor, equally, are the remarks made by Mr. P. Dvorkovitz as to the early work of Mr. Glasgow's plant. He might just as well have taken the figures of the predecessors of the present Lowe system. If anything beyond mutual recrimination is to be done in this matter, there must be no references to what happened or was done some time back, but the respective plants must be taken as found to-day.

Of the Lowe system of making carburetted water gas there are surely figures enough already published, while, in addition, we all have the results of our own work; and what is now wanted is the duty performed by this plant in making "blue" gas only, so that it may be judged on the same footing as its newer competitor.

Again I ask, I am sure in the interests of all, will not the acknowledged exponent of the older system oblige?

Feb. 25, 1903. CALIFACCION.

Brentford v. Old Kent Road.

SIR,—In a recent number of a contemporary, I read details of an interview between the paper's representative and Mr. Charles Carpenter, the Engineer of the South Metropolitan Gas Company, on the question of inclined retorts. Mr. Carpenter informed the representative that he was "tearing down," to the extent of £14,000 worth of property, his inclined retorts *because the Durham coals he received were unsuitable for them.* At the recent general meeting of the Brentford Gas Company, we read that Sir W. T. Makins attributes much of the success of the Company to *the use of inclined retorts.* As far as the writer knows, the Brentford Company use Durham coals; and very often from precisely the same pits as the South Metropolitan Company. Does it not seem extraordinary that a system working almost under the same conditions should be a practical success in the one case and a dire failure in the other?

Feb. 27, 1903. PUZZLED.

Suggested New Gas-Stove.

SIR,—I regret that Mr. Fletcher rejects my suggestion; but I remain convinced that in the "living-room" of the lower, middle, and working classes a compound stove suitable for heating and cooking in winter and for cooking in summer, is a more feasible idea than Mr. Fletcher's alternative of two stoves with their extra expense of fixing and rental and extra space required—the latter an important consideration.

The difficulty of construction, I purposely left to more experienced hands, but would suggest: (1) A smaller ball fire than the "H," as the greater length of flue would radiate more heat before reaching the chimney. (2) Rather less jets inside the ovens. (3) The two arrangements to be used conjointly or separately according to the season of the year and the discretion of the consumer.

Ornamentation—if not entailing prohibitory expense in an already costly form of stove—might be an inducement to some consumers; but there is not much in the ordinary coal-range. Utility and efficiency are primary considerations; and the gas-stove might present both in a superior degree to the coal-range.

My hope is that the suggestion may be more favourably received by other makers.

182, *Brecknock Road, N., Feb.* 26, 1903. A. CLEVERLY.

REGISTER OF PATENTS.

Heating and Lighting Burners.—Thompson, W. P.; a communication from Lorenz and Co., of Berlin. No. 5791; March 8, 1902.

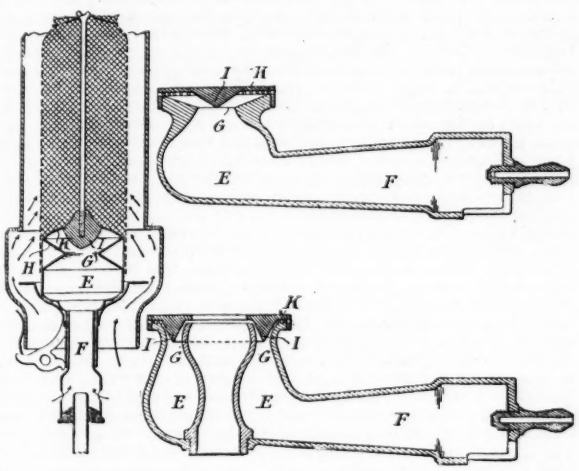
The illustrations show a longitudinal section of the burner when used for lighting purposes; a longitudinal section of the burner when used for heating and cooking purposes; and a similar view of the latter kind of burner arranged as a double burner.

The burner consists of a cylindrical mixing chamber E, into which a pipe F enters for introducing the mixture of gas and air. The mixing chamber has a constriction at its upper end, the diameter of the concentric mouth G of which constriction is somewhat larger than that of the tubular inlet socket or pipe F. A plain walled conically-shaped dish H also lies concentrically to this constriction; and above the dish there is a guide-piece I made of a downwardly directed cone with straight or curved sides, and held concentrically in its place by a wire network K fixed to the outer edges of the dish. By means of the dish and the guide-piece, the rising mixture of gas is driven outwardly with great energy, and at increasing speed owing to the rapid expansion of the dish—the speed of the gases having been previously diminished in the wide mixing-chamber E. The result of this is that a particularly

strong current of air is forced into the burner without diminishing the gas-pressure, which, of course, allows of a great development of flame.

In the form adapted for use as an incandescent gas-burner the style of burner described is employed; but the attachment of the guide-piece I to a wire network K is so arranged that the upper edge of the cone stands above the upper edge of the burner. This construction possesses the advantage that the mixture of air and gas is thrown with greater energy in such a direction against the wall of the incandescent mantle, that the flame is forced outwardly—thus encountering an outer air current at an acute angle. By this means, "any cooling action of the outer air current on the mantle is prevented; while its oxygen is utilized for producing an intense combustion."

In order to further increase this action, in the case of lighting burners, the outer air may be obliquely guided against the mantle, so that the mixture of gas and air from the inside, and also the air from the outside, encounter one another at an acute angle. The mantle is



thus practically between two currents, which produces the highest incandescence. This oblique guidance of the outer air is obtained by the arrangement of a dish or gallery bottom beneath the edge of the burner, which leaves an annular side opening free at a greater or less distance from the vertical axis of the burner, through which the outer air is drawn in. The oblique direction of the air against the mantle is determined by this annular opening. As shown, a cylinder having a constriction may also be employed which more definitely causes the oblique directing of the air—the cylinder being diminished in size above the mantle in order to increase the suction of the cylinder.

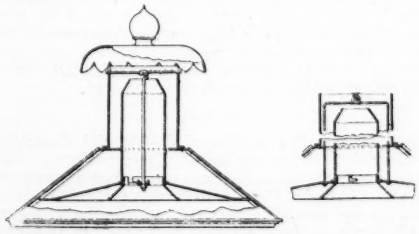
In the burner adapted for use as a gas-heating burner, the intense mixing and action is obtained by a somewhat similar constriction G to the one described. The guide-piece I is in this case preferably connected with a burner-plate K, which allows the gas an annular exit with the object of preventing water from penetrating into the mixing-chamber when the burner is in use as a gas-cooker, should a vessel boil over.

In the double form of burner for heating and cooking purposes, the mixing chamber E forms an annular space, and the guide-piece I is also formed as a ring in order that the discharge of the air and gas mixture may have the form of a double ring—that is to say, that there may be a ring of flame in the interior, and a second concentric ring of flame on the outside. By this means it is possible to have the bottom of the vessel approximately uniformly heated by the flame over its entire surface. An annular plate K is arranged over the guide-piece I, by means of which the two annular exit-openings are covered over, so that they are protected against the penetration of water which may boil over.

Reflectors for Street-Lamps.—Schwab, M., and Greene and Son, Limited, of Mark Lane, E.C. No. 23,117; Oct. 23, 1902.

This invention specially relates to reflectors for street-lamps of the kind described in patent No. 5867 of 1893—the object being to prevent the discolouration of the enamel or porcelain reflectors which occurred through an excess of the hot products of combustion collecting beneath the reflector, and not passing readily away through the central outlet.

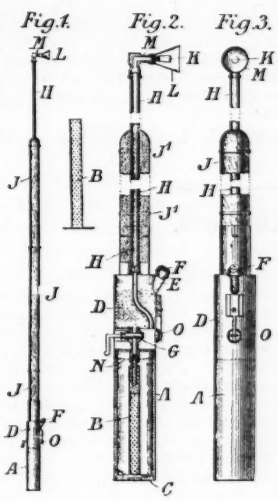
As shown in two separate forms, the patentees provide the outlet or outlets in the reflector with a coned, bell-mouthed, or flared entrance



projecting from the under surface of the reflector, so as to conduct the products of combustion to the outlet, and prevent them from collecting to any appreciable extent against the under surface of the reflector. This coned or flared part is preferably also of reflecting material, and is interchangeably fixed to, or formed in one with, the reflector proper. The coned part tends to increase the draught, and so prevent the products of combustion from depositing or injuring its reflecting surface to such an extent as would otherwise be the case, and, moreover, the cone when detachable may be readily replaced by a new one.

Acetylene Torch for Lighting Street-Lamps.—Gibbons, W. P. & G. B. A., of Dudley, and Ivern, P., of Barcelona. No. 4838; Feb. 26, 1902.

The illustration shows: Fig. 1 a general view of an acetylene-torch constructed in accordance with this invention; fig. 2, a sectional elevation on a larger scale with some of the parts broken off; fig. 3, a front elevation on the same scale as fig. 2; and fig. 4, the perforated cylinder (separately) for containing the carbide.



At the bottom of the lower part of the torch is the gas-generator A, of tubular form, and containing the perforated cylinder B (of smaller diameter) to hold the carbide of calcium. By unscrewing the cap C, the cylinder B can be withdrawn and refilled when necessary. Fixed on the bottom end of the cylinder B is a flange, on which the cylinder stands, the top end being open; and into this top end takes a short pipe from the water-tap G. Fixed to the top of the generator is the water-vessel D (by preference, of tubular form), provided with a filling hole E and cap F; and from it the water passes to the chamber A through the tap G, by which the water supply can be regulated or entirely cut off. The tap can be an ordinary plug-tap with a handle outside, so that it can conveniently be turned on or off and the water supply regulated by the thumb while the generating part of the torch is grasped by the hand. The tap projects downwards, and has a short outlet-pipe at its lower end, which takes into the upper end of the cylinder B and is provided with a wick or other suitable material in the pipe to make the water drip properly on to the carbide. Projecting from the top of the water-vessel D is a tube H communicating with the chamber A by a smaller tube which passes through the water-vessel D, and is connected water-tight to the top and bottom of the same respectively. At the top of the tube H is the burner K, preferably arranged at right angles to the tube, though, if desired, the burner may project in a line therewith; and round the burner there is a suitable shield L for the flame. By making the fitting at the top of the tube H in the form of an elbow M, this will form a hook for turning on the gas. The gas as generated passes up through the filtering medium N in the upper part of the generator, and then flows by the small tube I through the water-vessel D, and up through the tube H to the burner K. The generating chamber is provided with a safety or relief valve O to prevent excessive pressure.

APPLICATIONS FOR LETTERS PATENT.

3620.—M'Elroy, J. F., "Illuminating railway trains or the like." Feb. 16.

3641.—Wolters, H. A. R., and Sager, L. A., "Chimneys for gas and like burners." Feb. 16.

3663.—Bickerton, H. N., Bradley, H. W., and Clerk, D., "Internal combustion engines." Feb. 16.

3679.—Craig, G., "Production of cyanides." Feb. 17.

3685.—Shepherd, J., "Gas economizer." Feb. 17.

3742.—Stumpf, J., "Turbines operated by steam or gas." Feb. 17.

3749.—Johnson, A., and Mansergh, W., "Gas-meters." Feb. 17.

3770.—Sebille, E. E., and Ryckman, S. S., "Incandescent gas-mantles." Feb. 17.

3771.—Sebille, E.C., and Ryckman, S. S., "Incandescent gas-burners." Feb. 17.

3780.—Du Bois, E., "Coin mechanism for meters." Feb. 17.

3791.—Jackson, W. M., "Automically mixing acetylene with other gases." Feb. 18.

3817.—Hendy, J., and Stobart, H. J. S., "Incandescent gas lighting." Feb. 18.

3818.—Lester, I. E., "Lighting and heating by gas." Feb. 18.

3852.—Brookes, A. G., "Generator-furnaces with inclined retorts." A communication from Stettiner Chamotte-Fabrik A.-G. vormals Didier. Feb. 18.

3874.—Bolz, C., "Gas-burners." Feb. 18.

3899.—Stenhouse, T., "Utilization of waste gases from ammonical liquor." Feb. 19.

4012.—Morris, E. F., "Producer-gas generators." Feb. 20.

4019.—Bauke, F., and Fuchs, C., "Generating water gas." Feb. 20.

4032.—Friedrich, A., "Lighting and extinguishing from a distance gas-jets furnished with bye-passes." Feb. 20.

4046.—Brookes, A. G., "Distilling tar and coal-tar oils." A communication from Rütgerswerke-Actiengesellschaft. Feb. 20.

4052.—Sugg, W. T., "Burners for testing gas." Feb. 20.

4091.—Hoerbiger, H., and Rogler, F. W., "Distributing energy from a distance by means of combustible gases." Feb. 20.

4100.—Jensén, J., and Nielsen, T. T., "Regulating the admission of gas or air to stoves and the like." Feb. 20.

4116.—Mason, J., "Anti-vibration devices for incandescent fittings." Feb. 21.

4172.—Hurschmann, O., "Gas-burners." Feb. 21.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress has been made with Bills:—

Bills presented and read the first time: Bournemouth Gas and Water Bill, Belfast Water Bill, Birmingham Corporation Bill, Bradford Corporation Bill, British Gaslight Company (Norwich) Bill, Bury and District Joint Water Board Bill, Chard Corporation Gas and Electricity Bill, Derby Gas Bill, Faversham Gas Bill, Harrogate Water Bill, Harrow and Stanmore Gas Bill, Hexham Gas Bill, Nantwich Gas Bill, Nantwich Urban District Council Bill, North-Western Electricity and Power Gas Bill, Oldham Corporation Bill, Plymouth and Stonehouse Gas Bill, Rickmansworth Gas Bill, Scunthorpe Urban District Water Bill, Shepshed Urban District Gas Bill, Torquay Corporation Water Bill, Wellington (Salop) Gas Bill.

A petition has been presented against the last-named Bill by the Wellington Urban District Council.

HOUSE OF COMMONS.

The following progress has been made with Bills:—

Bills presented and read the first time: Barnsley Corporation Water Bill, Bath Corporation Water Bill, Billingshurst and District Gas Bill, Bridgwater Gas Bill, Broadstairs Gas Bill, Burgess Hill and St. John's Common Gas Bill, Commercial Gas Bill, Crystal Palace District Gas Bill, East Ardsley Gas Bill, Ebbw Vale Water and Improvement Bill, Gaslight and Coke Company Bill, Gaslight and Coke Company's Acts Amendment Bill, Gorleston and Southtown Gas Bill, Hampton Court Gas Bill, Hyde Corporation Bill, Ipswich Gas Bill, Kent Water Board Bill, Leigh Corporation Bill, London County Council (General Powers) Bill, Maidstone Gas Bill, Market Drayton Gas Bill, Merthyr Tydfil Urban District Council Bill, Nanty-glo and Blaina Water Bill, Nelson Corporation Bill, New Hunstanton Improvement Bill, Newcastle-upon-Tyne Electric Supply Bill, North Middlesex Gas Bill, Scarborough Gas Bill, Sittingbourne District Gas Bill, Sutton District Water Bill, Walker and Wallsend Union Gas Bill, West Sussex Water Bill, Winchester Water and Gas Bill.

A Bill to make further and amended provisions to prevent the pollution of rivers and streams has been brought in by Sir Frances Sharp Powell; and one to legalize the peaceful conduct of trade disputes, and to alter the law affecting the liability of Trade Union funds, by Sir Charles Dilke.

The first business at the evening sitting of the House of Commons to day will be the consideration of the following motion standing in the name of Mr. Hoult: "That the constitution of the Board of Trade has become obsolete, and this House is of opinion that a department presided over by a Minister of Commerce and Industry, having the status of a principal Secretary of State, should be substituted for the present office, to which should be entrusted all matters more particularly appertaining to commerce and industry; and to that end that an inquiry should be forthwith instituted, with the view of rearranging the duties and functions of existing departments." To this Sir Charles Dilke proposes to move an amendment calling upon the Government to undertake a redistribution of duties between the various Government departments concerned, with due regard to the interests of labour.

Bursting of a Water-Main.—Serious inconvenience was caused at Gloucester last Friday morning by the bursting of the water-main from the Corporation reservoirs at Newent. A large body of water was wasted before the break was located about five miles from the city. The water was turned on from the other Corporation reservoir at Witcombe; but it rushed through the city mains, and out of the broken pipe, until the valves could be closed. In the meantime, the city was without a supply. There was a fall of 9 feet in the reservoir; and as every foot represents 90,000 gallons some idea of the enormous loss of water may be formed.

Carlisle Water Scheme.—It may be remembered that the Geltsdale Water Committee of the Carlisle Corporation had a case submitted to Mr. Balfour Browne, K.C., on the advisability of abandoning the Act sanctioning the gravitation water scheme which has given the Corporation so much trouble. An interview recently took place between certain members of the Committee and Mr. Browne, in the course of which he recommended that the scheme should be proceeded with, as to have the Act repealed would, having regard to the obligations under which the Corporation are placed, cost more than the actual carrying out of the scheme.

Lancaster Corporation Gas Supply.—The result of the past year's working of the gas undertaking of the Lancaster Corporation (under Mr. Charles Armitage, Assoc.M.Inst.C.E.) is that, instead of £773 being available for the reserve fund, as the Gas Committee estimated would be the case, they will be able to place £3000 to that fund, after providing £1500, as promised, in aid of the rates. At the monthly meeting of the Town Council last Wednesday, the Chairman of the Committee (Alderman Holme) pointed out that, by placing this sum to the reserve fund, it would tend to strengthen it after its depletion to the extent of £3000 for the improvements at the gas-works, in order to bring them up to a state of efficiency, so as to be able to cope with the steady increase in the consumption of gas which put them in the happy position they were now able to report.

MISCELLANEOUS NEWS.

PARIS GAS SUPPLY.

Fourteen Years' Progress—The Competition for the Concession.

Those of our readers who have followed the Paris Gas Question through its latest phases will probably remember that towards the close of 1901 a Technical Commission was nominated by the Prefect of the Seine to investigate the subject of the future gas supply of the city, in view of the expiration of the existing Company's concession on Dec. 31, 1905. At one of their sittings, the Commission took into consideration the quantity of gas which it would be necessary to provide when, as the result of a reduction in price, the consumption increased. It was pointed out by Inspector-General Boreux that M. Lauriol, the Engineer-in-Chief of the lighting services of the city, had estimated, taking as the basis of his calculations the consumption of 303 million cubic metres in 1899, a rise to 370 millions. M. Alavoine remarked that at Fontainebleau the private consumption had doubled in less than ten years as the result of a reduction from 30c. to 20c, and 18c. per cubic metre; while another member stated that in certain cases which had come under his notice, it had gone up 30 per cent. in three years, without any alteration being made in the charge. As it was thought that this complicated subject would lead to the production of very varying estimates, it was decided to get out the quantities of gas produced by the Paris Gas Company in the fourteen years ending with 1901, and ascertain how the private consumption had changed, and what proportion of it was used in the daytime—that is to say, between sunrise and sunset. Tabulated statistics were accordingly prepared furnishing particulars of the total production of gas and the quantity used by private consumers and for the public lighting both in the city and the suburbs. The latter figures being deducted from the former, the proportion unproductive of revenue would be shown. With regard to the gas unaccounted for, it was deemed to be sufficiently near exactitude to divide it equally between the day and night consumptions. The annual reports of the Company give the ratio of day gas to the total production; so that these enabled the volume to be ascertained. With regard to the suburbs, as precise data were not available, 20 per cent. of the total was taken as the maximum day consumption for ordinary domestic purposes. The statistics thus obtained are given in the accompanying table.

The figures there presented tell their own story with sufficient clearness to render unnecessary any explanatory observations. It may be pointed out, however, that the total production in the fourteen years rose from 297,697,820 cubic metres to 335,803,091 cubic metres. This increase of 38,105,271 cubic metres represents an average of 2,721,805 cubic metres per annum. The proportion of day gas, which in 1888 was 27 per cent. of the total production, was 36·8 per cent. in 1901, or an average yearly increase of 0·7 per cent. The annual consumption by private persons in Paris rose to the extent of 28,119,605 cubic metres in the period under consideration; being an average of 2,163,000 cubic metres per year. Into this consumption the day gas enters in quantities varying from 32 to 44·4 per cent., giving an average of 0·95. The number of private consumers went up from 193,165 in 1888 to 438,994 in 1901, or at the rate of 18,910 per annum; but while the total number increased, the average annual consumption per head decreased from 1124 to 559 cubic meters, or about 40 cubic metres per annum. Moreover, the day and night consumptions are becoming less disproportionate.

With regard to the increased consumption to be anticipated as the consequence of the adoption of a lower price, the Commission made the following observations: In 1901 the consumers in Paris numbered 438,994, or about one-sixth of the total population; and it appears hardly probable that they will increase by 100,000. What may be called the commercial use of gas—*i.e.* for warehouses, shops, &c.—tends to decrease, owing to early closing being now more general. Incandescent gas lighting, again, though it will not check the consumption of gas, will retard its development. Consequently, there is likely to be but little variation in the quantity of gas used for the purposes specified above. Day gas is already employed in the kitchen and for other domestic purposes by those consumers who can pay the attendant expenses; and they will be likely to use more if the price is lowered. In this direction, therefore, and in the accession of new customers, further progress may be expected. The use of gas being more economical than that of electricity, it is possible that the latter may be partially abandoned, to the benefit of the older illuminant. Electric lighting represents about 60 million cubic metres of gas per annum; and it is difficult to suppose that much more than one-sixth of this volume will be lost, the consumers having become habituated to its use.

As the result of their investigation, the Commission came to the conclusion that the probable increase in the consumption of gas that would follow a reduction in price would be about 60 million cubic metres, apportioned as follows: Additional consumers and the development of day consumption, 40 to 50 millions; consumers abandoning electric lighting, 10 to 15 millions. They thought, however, that some years would elapse before this result was achieved.

In compliance with the request of the Special Committee of the Municipal Council of Paris who have under consideration the question of the future supply of gas to the city, whose recent proceedings were noticed in the "JOURNAL" a fortnight ago (*ante*, p. 426), the Prefect of the Seine (M. de Selves) attended a meeting of the Committee, and expressed his views on the subject of the control of the supply by the Municipality. In response to an inquiry as to his reason for not dealing with this matter in his report, he said it was because he did not consider the present time opportune for such an undertaking. The Committee, however, manifested a desire to study the question

——	1888.	1890.	1892.	1894.	1896.	1898.	1900.	1901.
Total annual production of gas, in cubic metres	297,697,820	307,861,880	308,900,930	300,823,710	318,020,000	320,031,250	349,913,918	335,803,091
Loss by leakage, &c.	15,174,091	17,827,555	16,648,507	16,688,388	19,294,833	21,380,430	23,670,312	20,270,132
Total annual consumption	282,523,729	290,034,325	292,252,423	284,135,322	298,725,167	298,650,820	326,243,306	315,532,959
Gas used for public lighting—								
In Paris	44,699,716	45,441,785	46,044,043	45,667,295	47,176,582	45,894,469	42,156,892	40,706,001
In the environs	4,407,035	4,470,193	5,952,816	6,500,290	6,950,799	7,071,197	7,251,749	7,088,171
Gas used by private consumers—								
In Paris	217,257,001	222,999,687	222,766,419	214,234,881	226,332,787	226,234,628	253,914,785	245,376,606
In the environs	16,159,977	17,122,660	17,489,145	17,732,856	18,265,099	19,450,526	22,919,880	22,362,181
Number of private consumers—								
In Paris	193,365	211,923	228,565	256,068	320,250	368,035	421,324	438,994
In the environs	19,150	21,087	23,248	25,149	27,045	29,605	33,994	34,662
Average annual consumption per head, in cubic metres	1,124	1,052	975	837	707	615	603	559
Percentage of day gas included in the total production	27·0	26·15	27·35	29·06	30·49	32·76	35·35	36·80
Do. used by each private consumer in Paris	32·0	30·50	32·60	35·20	36·90	39·80	42·20	44·40

thoroughly; and accordingly they resolved to ask the Prefect to prepare a report on the point before them, and submit it with as little delay as possible. He neither assented nor dissented; and his general bearing seems to have created the impression, outside the Committee-room, that if he did report he would not throw much light on the matter. The Committee then proceeded to consider the proposal of the Gas Company, and decided to ask their representatives to attend and state whether the shareholders had authorized them to make any fresh proposals, and whether they adhered to their decision as to the valuation of the assets of the Company. At their next sitting, the Committee took up the offer of MM. Devaluez, Duchanoy, and Grévy, who represent the American group of competitors for the concession. M. Devaluez was present, and he explained, in answer to the Chairman (M. Deville), that he and his colleagues had constituted some financial syndicates, and their guarantee would be furnished by Frenchmen as well as by Americans. At all events, the bonds would be issued publicly, and members of the Board would be Frenchmen. M. Dehaynin, a former municipal councillor, then submitted himself to an examination on the features of his scheme. He promised that if it was accepted he would be satisfied with one-third of the profits, handing over the rest to the Municipality. This offer was favourably regarded. When the Committee met again, the Prefect of the Seine presented his report on the question of municipal control. He set forth therein the various reasons which had led him to reject this system of managing the gas supply, and strongly advised the Municipal Council to adopt one of the five schemes he had recommended. Two of these—by M. Damour and M. de Sinçay—were then considered; and this brought the sitting to a close.

On Monday last week the consideration of the schemes was resumed. A bold bid was made by Mr. Francis Laur, who proposed to form a company with a capital of 20 million francs, supply gas at 8c. per cubic metre (1s. 9¾d. per 1000 cubic feet), and hand over half the profits to the Municipality. This was an astonishing offer; but a more surprising one followed. It was submitted by M. Raoul Pictet, whose scheme, it may be remembered, the Prefect of the Seine and the Municipal Engineers had discarded as impracticable. He told the Committee that water gas was the cheapest they could have; but, unfortunately, although it cost only 2·5c. per cubic metre (6¾d. per 1000 cubic feet), it could not be used alone, as it contained 30 per cent. of carbon monoxide, which rendered it dangerous. He assured them, however, that he was the inventor of a process by the application of which the gas could be freed from this dangerous constituent without increasing its net price. He said he was in a position to supply pure gas to Paris at the rate of 5c. per cubic metre (1s. 1½d. per 1000 cubic feet), with a 10 per cent. increase in illuminating power. He added that at the present time his process was being applied in works in Manchester, and if the Committee were desirous of information in regard to the results obtained, he was at their disposal; or he would give them some practical demonstrations of it wherever they pleased. He had not formed any company; and, if required, he would hand over his patents to the Municipality for use in any way they might see fit. These statements caused some astonishment; and at the close of the sitting the members of the Committee conversed together as to arranging with M. Pictet for an experimental trial of his process.

Thus far the gas question had been confined to the Committee. Last Wednesday, however, it came before the Municipal Council itself, at a special sitting which was originally fixed for the previous Monday, but deferred for two days at the suggestion of the President (M. Paul Escudier), in order to give the Committee more time for a thorough examination of the Prefect's report. The whole of the afternoon and evening till past seven o'clock was spent in hearing the views of the projectors of the various schemes, without any decision being arrived at. The next day the discussion was resumed at four o'clock and continued till half-past eight; and it resulted in the settlement of one important question—viz., should there be direct control? After a free enunciation of views on the matter, the Prefect of the Seine spoke the last word on municipalization, and it was "impossible." A vote was taken on the proposition of M. Poirier de Narçay to the effect that the supply of gas should be in the hands of the City; and it was lost by 41 votes to 35. The next contest took place over a proposal by M. Grébauval that the City should acquire and work the gas undertaking by means of a loan of 200 million francs, to be redeemed by a sinking fund in 35 years. But, having passed a resolution rejecting municipalization, the members of the Council were not in a mood to deal with the new proposition; and so they referred it to the Committee. This was as far as matters had advanced up to Thursday night. No sitting took place on Friday; and Saturday was fixed for a ball. Yesterday the Council were to deal with sanitary matters; and so the gas question drags on.

NOTTINGHAM CORPORATION GAS UNDERTAKING.

Reports by Sir George Livesey and the Engineer.

It will probably be in the recollection of many readers that the presentation of the annual report of the Gas Committee of the Nottingham Corporation at the meeting of the City Council early in September last gave rise to some adverse criticisms by Alderman Radford of the management of the undertaking, the unfavourable results of which, it was pointed out, were in striking contrast to those obtained at Sheffield. These criticisms were dealt with in a special report by the Gas Committee, who secured the services of Sir George Livesey to investigate the matter. The new Engineer and Manager (Mr. J. H. Brown) was also instructed to report upon the position of the works. The reports were distributed to the members of the Council early last week, in view of their consideration at yesterday's meeting. The Committee received two reports from Mr. Brown—one before and the other after Sir George Livesey's; and in a short prefatory note the Chairman (Alderman Ford) states that some of the latter's recommendations had been anticipated by Mr. Brown, and were actually being carried out. He adds that the reports are receiving the most careful attention of the Gas Committee; and where they find it will be advantageous to give effect to such recommendations as have not yet been adopted, this will be done without delay. The following is

SIR GEORGE LIVESEY'S REPORT.

In compliance with your request to inspect your gas-works and report generally on "the methods of manufacture and the commercial aspects of the undertaking," I made a close examination of your three manufacturing stations on the 27th of October last, and obtained, either then at the office or later from your Accountant, full information, with copies of the annual accounts for the last fifteen years. I have also had placed in my hands the reports of the discussion on the gas undertaking in the Council and the reply thereto of the Gas Committee; and I have obtained much information from "Field's Analysis" of gas accounts. I desired to make no reference to the past, because I wished to avoid all reflections (and I will avoid them as much as possible) on the management; but I find that to deal satisfactorily with the future some notice must be taken of the past. I find this can best be done by making certain comparisons with Sheffield, as that town has been specially mentioned. Comparisons, however, are always of limited value, because there are generally variations in the conditions and circumstances of the subjects of the comparison.

There is no gas undertaking in the kingdom better managed than the Sheffield Gas Company. Its Chairman is a very able man of business, has been long in that position, and has great personal interests in the welfare of the Company. The commercial part of their business is dealt with by an extremely capable General Manager, who is the executive officer for the buying of coal and the selling of coke and other residual products. The Engineer is therefore free to give all his time and attention to the development, maintenance, and management of their three works, and to the distribution of the gas. These duties are quite sufficient to keep him fully employed. In small concerns, one man must be engineer, manager, and everything—in fact, more perhaps of the manager than the engineer; but with large undertakings such as yours, a division of labour is essential. There is another reason. No man is a universal genius; and, speaking generally, although there may be exceptions, the man who by instinct, inclination, and training becomes a capable engineer is not likely to possess in a high degree, and moreover has not had the opportunity of training and developing, the commercial faculty. It is therefore well to keep, when practicable, the duties separate.

An important point in the comparison, to the disadvantage of Nottingham, but for which no credit can be given to the Sheffield Gas Company, is the relative increase in the population of the two towns in the last decade. This accounts for a considerable proportion of the difference in the rate of increase in the consumption of gas. As a further comparison, I have also taken out the corresponding figures for Leicester (see p. 564).

These figures are only approximately correct, because the lighting area is not likely to correspond exactly with the area covered by the census in any case; but the great increases in Leicester and Sheffield are doubtless largely due to the increase of population, which, in addition to the mere increase, indicates a prosperous condition of trade or the reverse. At any rate, the census figures give me the impression that the trade of Nottingham has not been in so prosperous a condition as that of Sheffield; and, if so, the consumption of gas

	Leicester.	Nottingham.	Sheffield.
Population in 1891	174,624	213,877	324,243
,, 1901	211,574	239,743	380,717
Increase	36,950 = 21 p. c.	25,866 = 12 p. c.	56,474 = 17½ p. c.
Consumption of gas—			
Increase in 15 years	100 p. c.	38½ p. c.	97 p. c.
Last year, per head of population	7,990 c. ft.	7,130 c. ft.	7,190 c. ft.
Last year, per consumer of gas	34,012 ,,	33,253 ,,	38,442 ,,

certainly would not increase at the same rate. It may with equal certainty be said that this is not the fault of the gas undertaking. But the great increase of 97 per cent. in the gas sold in Sheffield compared with Nottingham's 38½ per cent. has been greatly to the advantage of the former, because it is by means of large annual increases that the capital relatively to the business done is reduced.

For instance, suppose ten years ago the capital of a gas undertaking stood at 12s. per 1000 cubic feet sold in the year, and suppose 100 per cent. increase of business in the ten years has been met by an expenditure of capital at the rate of 6s. per 1000 cubic feet on the additional business, it follows that the total capital will stand at 9s. per 1000 cubic feet. If the increase of business were only 50 per cent. at the 6s. rate, then the capital would stand at 10s. 6d. per 1000 cubic feet sold. Thus, although the capital actually increases in the total amount, yet relatively to the business done it is reduced. From 1886 to 1901, Nottingham and Sheffield stood thus, according to "Field":—

Capital Employed per 1000 Cubic Feet.

	1886.	1901.
Nottingham	14s. 1d.	12s. 5d.
Sheffield	9s. 3d.	6s. 8d.
	Nottingham.	Sheffield.
Relative reduction in 15 years	1s. 8d.	2s. 7d.

The greater relative reduction in Sheffield is largely due to the much greater increase of business. The Nottingham figures are higher than Sheffield because the capital consists of annuities and loans at a low rate of interest; but taking the interest paid per 1000 cubic feet, Sheffield is higher than Nottingham both in 1886 and 1901:—

	1886.	1901.	Reduction.
Nottingham	7¾d. per 1000	6¼d.	1½d.
Sheffield	11d. ,,	7¾d.	3¼d.

Last year it cost Nottingham 1½d. per 1000 cubic feet less to pay interest on capital than Sheffield; but this advantage was given away in the £24,000 paid in aid of rates (equal to 3·3d. per 1000 cubic feet sold). The account therefore stands thus:—

Sheffield for interest on capital	7·70d. per 1000 feet
Nottingham ,, ,,	6·22d. ,, ,,
Nottingham in aid of rates	3·30d. ,, ,,

The two payments are equal to 9·5d. per 1000 feet. Thus nearly 2d. of the difference in the price of gas is accounted for. Interest on capital is a large item in the price of gas, and efforts should be constantly made to reduce it.

One of the most important duties, either of the directors of a gas company or the gas committee of a corporation, is to keep a very careful watch on the capital account. When this is not done, there is the danger that the capital will increase at a greater rate than the business; whereas, to be on the safe side, it is necessary that the business shall increase relatively faster than the capital. The latter has been the case both at Nottingham and Sheffield; but in this particular Sheffield comes out best. I find in the last fifteen years that the Sheffield capital expended on the additional business has been at the rate of 4s. per 1000 cubic feet sold, or (say) £200 per million cubic feet. This is very low. At Nottingham it has been at the rate of 7s. per 1000 cubic feet, or £350 per million; but I cannot regard this as at all seriously excessive—6s. per 1000 cubic feet, or £300 per million, being quite as low as can be expected. This was the rate in the first twelve out of the fifteen years under review; but, taking the last three years, I find the additions to capital expenditure, less £2000 depreciation of stoves, amount to £89,515—while the increase in the gas sold is 181,723,000 cubic feet, being more than 9s. 6d. per 1000 feet, or £475 per million. I suppose this is due to the installation of inclined retorts and the adoption of machinery; but the question arises whether too much of the cost has been charged to capital and too little to revenue, though I notice that good round sums have been charged to the latter. To act on the wise and safe policy of keeping the capital account down, the cost of renewals and improvements of old plant should all be charged to revenue.

It is possible to go too far in the use of machinery. Its main object—in fact, its only object—is to save manual labour. The point of greatest economy, I believe, is found in a great reduction, rather than attempting the entire abolition, of manual labour. In short, in this as in most other matters, the last few points cost much more in proportion than the bulk. It is therefore better to be content with something short of perfection. I have never wished to be able to say, "From the entry of the coal into the works to the exit of the coke, nothing is touched by hand," because I believe that to be going beyond the point of the greatest economy. As a set-off to the saving of labour by the use of machinery for removing coke, there is the serious injury done to it by breaking and converting it into breeze. I do not say coke should not be removed by machinery, for it is the proper course; but the damage it does to the coke must never be forgotten, and all practical means must be taken to minimize it. With these reservations, I recommend the use of machinery wherever practicable, though in connection with it I should not go to the expense of a great coal-hopper over every setting of retorts, as has been done in part of the large retort-house at Basford. The question naturally arises: As a labour-saving appliance, which is the better—horizontal retorts with drawing and charging machinery such as at Basford, or inclined retorts such as at the Eastcroft works? Possibly, all things considered, inclined retorts stand first as labour-savers. But this is not all; for, unless the right sort of coal is used, which is not always obtainable, the result is very unsatisfactory. I find that at the Eastcroft works there was a serious falling off in the make of gas per ton of coal used after the inclined retorts were started in May, 1900. The following are the figures for the last four years—that is, two before and two after:—

	Coal Used, Tons.	Gas Made, Cub. Ft.	Rate per Ton, Cub. Ft.
March 31, 1899	46,888	498,100,000	10,623
,, 1900	45,377	468,836,000	10,332
,, 1901	74,303	710,730,000	9,565
,, 1902	65,306	654,781,000	10,026

There are two retort-houses at the Eastcroft works—one being fitted with horizontal retorts worked by hand, and the other with inclined retorts worked with coal-feeding and coke-removing machinery. Therefore, had the whole works been on the latter system, the falling off in the make of gas per ton would have been much greater. The inclined retorts only were worked from April 28 to Aug. 23, 1901, with the following result: Coal used, 16,373 tons; gas made, 152,898,000 cubic feet; rate per ton, 9338 cubic feet. Seeing that the average make per ton for the whole of that year was only 9565 cubic feet, it is extremely likely that the make of the inclined retorts through the twelve months did not average so much as 9300 cubic feet. They appear, however, to have done somewhat better in the following year. The reason is the use of unsuitable coal. The peculiarity of inclined retorts is that coal that will not slide or "creep" must be used, or the make per ton will seriously fall off—perhaps to even less than 9000 cubic feet per ton of coal. To make your inclined retorts a success, you must ascertain by practical experiment what coal is suitable, and use that and no other. I recommend that next summer the inclined retorts only be worked—the horizontals all being put out of action. You can then try for a week—or, better, a fortnight—at a time each class of coal, in order to discover whether it will lie in the retort without slipping, and to learn how much gas it makes per ton. Many kinds of coal, as they become heated, slide down the retorts, leaving the upper part empty, and blocking up the lower end. The result is that from the mass at the bottom end a large proportion of the gas is not evolved, and the make per ton is correspondingly reduced. I have no doubt that this often happens at the Eastcroft works to a greater or less degree. If the inclined retorts are worked separately, what they do is known; but if at the same works there are also horizontal retorts, there is no knowing what the inclined retorts are doing when both are worked together.

The South Metropolitan Gas Company about five years ago fitted one of their retort-houses at the Old Kent Road works with inclined retorts, which could not be worked separately. The make of gas was not so good as it should be; but it did not occur to the management for some time that the inclined retorts had something to do with it. Fortunately for the Company, at about the same time their smallest works, situated at Bankside, had all the horizontal retorts replaced by inclines, and then the make of gas per ton fell to 9000 cubic feet, and often even less. After much investigation and experiment, the cause was found in the use of unsuitable coal. Further experiment showed which coal was suitable; and now the make of gas at that small station is as satisfactory as at any other. It has been found that, with little or no apparent difference in the appearance of coal from various pits in the North (Durham), whence the London supply of gas coal mainly comes, some will answer and others will not for inclined retorts, although in horizontal retorts there is little difference in working coal from the various pits. I believe that with Midland coal there is less risk of its slipping or "creeping" in inclined retorts, and that consequently there is a larger choice; but that some of your coal does slip I had striking evidence on my visit to the Eastcroft works, for I saw a retort being drawn in which the charge was jammed into a solid mass at the lower mouthpiece, and was more trouble to draw than any horizontal retort, while not nearly the whole of the gas had been extracted from the coal. In other cases the charges came out most readily, and the coke was well burnt, and contained no gas. The difference was entirely due to the use of unsuitable coal in one case and suitable coal in the other. I have the satisfaction of saying that I can attach no blame to the Manager of the works; for, with the great variety of coal supplied, mixtures can hardly be avoided, and selection is impracticable. This, however, can be remedied.

I do not recommend any extension of inclined retorts at any of your works until you have, by practical experiment with those at the Eastcroft, proved their advantages. Then, should you be satisfied on this point, and having ascertained that suitable coal can be obtained at a reasonable price, I would convert the other retort-house at the Eastcroft to the inclined system, and have none others at that station. You will then always be in a position to know exactly what they are doing. I would not mix the two systems at the same works. The South Metropolitan Company have found this so unsatisfactory, that they have determined next year to reconvert their inclined-retort house at the Old Kent Road works to the horizontal system worked by machinery. They will confine the inclined system to their smallest stations, which cannot well be adapted to machine stoking on the horizontal system because they are too small. To get the full advantage from stoking machinery a large retort-house such as that at Basford is necessary, where the machines can be worked to their full power.

I recommend the use of gaseous firing for all your retorts at all the stations. The advantages are a great saving of fuel and better control over the heating of the retorts. Higher heats are also practicable; the wear and tear being considerably less with gaseous than with direct firing. For gaseous firing what are known as generating furnaces are used; they may be simple generators, or they may be of the more complex form known as regenerators—that is, the waste heat of the products of combustion after they leave the retorts is used, by means of a rather complicated arrangement of flues, to heat the air supply. This arrangement adds materially to the cost of the setting, which reduces the advantage of the regenerator system, which I am disposed to regard as one of those "counsels of perfection" that are of doubtful advantage.

The usual plan is to have generators in the place of, but at a lower level than, the ordinary furnaces in each setting of retorts. This necessitates a rather deep excavation below the retort-house floor, and would be hardly practicable at your Radford works, where the small river or brook passes under a retort-house. But where the excavation is practicable, it is both troublesome and expensive. Fortunately there is a better way. Instead of small generators for each setting of retorts, it is much better to construct a large generator—it may be above ground—quite outside the retort-house, to supply gaseous fuel for (say) eight or ten beds or settings of retorts. This plan has been adopted successfully in many places, and is one that I strongly recommend. These large generators can be put in any convenient position by the side or at the end of the retort-house, where coke can be conveniently supplied. As to chimneys, a more uniform draught is obtained by a number of small chimneys (but little higher than the roof of the retort-house) than by one lofty and expensive structure, however highly ornamental. In fact, tall chimneys are now frequently put out of use, and even pulled down, and a number of short ones substituted. Speaking generally of the retort-houses, I must say of those worked by hand labour that they have been good in their day, and are such as will still give good results; but hand labour must, to a very great extent, be superseded by stoking machinery or inclined retorts, for the simple and all sufficient reason that considerable savings can thereby be effected. Unfortunately, retort-houses built for manual stoking are commonly too narrow for machinery; and even for inclines they need reconstructing. This is, of necessity, a very gradual process; but it should be the goal at which you are aiming. Gas companies usually spread the work over a number of years, and thus are enabled to bear the burden of cost—charging the greater part to revenue. The retort-houses fitted with machinery or with inclined retorts are of good design, and capable of yielding excellent results. I must also say of the works and plant generally that they are well designed and constructed, good, sound, and substantial, and capable of doing very good work. If certain parts are not exactly in accord with modern gas engineering practice, they must not be lightly or hastily replaced. The object of the Engineer should be to use his ingenuity to adapt rather than replace them, pulling down as little as possible. There is not much to be gained by renewing purifying and other plant outside the retort-houses. As to purifiers, I much prefer, where space is available, to put them on the ground, rather than on a raised floor in an expensive house. If on the ground, they can be filled and emptied by hand labour, which, when circumstances are favourable, takes a lot of beating. The chemical works I have not seen, having reserved the inspection for my next visit, if that should be necessary. Judging, however, from the receipts for tar and ammonia, I do not imagine that they are at all defective. The receipts for tar are generally superior to those obtained at Sheffield; but the ammonia returns are not quite so good. This may be due either to the coal used (some kinds yielding more ammonia than others), or it may be due to better selling. In reference to tar and ammonia products, much depends on the salesman, who should keep a very close watch on the markets.

I must now direct attention to a more serious matter—viz., the price of coal and the yield of gas per ton. Taking the last fifteen years, and dividing them into two nearly equal periods, I find the average prices paid for coal and the make per ton were as follows:—

	Price of Coal per Ton.	Yield of Gas per Ton.
1887-1893 inclusive—		
Nottingham	9s. 9d.	10,425 cub. ft.
Sheffield	10 1½	10,148 ,,
1894-1901 inclusive—		
Nottingham	10s. 8d.	10,202 ,,
Sheffield	9 0½	10,321 ,,

The average price of Nottingham coal is 11d. per ton higher in the later period, and the make of gas per ton is 223 cubic feet lower. The average price of Sheffield coal is 13d. per ton lower in the later period, and the make of gas per ton is 173 cubic feet higher. Taking the averages of the first two years, and comparing them with the averages of the last two years, the figures are as follows:—

	1887-1888.		1901-1902.	
	Price.	Make.	Price.	Make.
Nottingham	7s. 10¾d.	10,514	13s. 3½d.	9,781
Sheffield	8 5¾	9,988	12 0½	10,288

In 1887-8, Sheffield paid 7d. per ton more for coal than Nottingham, and made 526 cubic feet per ton less gas. In 1900-1 Nottingham paid 1s. 3d. per ton more for coal than Sheffield, and made 507 cubic feet per ton less gas. In 1887 there was a difference of 2d. per 1000 cubic feet in the price of gas in favour of Sheffield, which increased to 8d. in 1901. Between the two periods, there is a gain of 1s. 10d per ton in the cost of coal in favour of Sheffield, coupled with a further gain of 1033 cubic feet per ton in the make of gas. These items alone are sufficient to account for Sheffield's 2d. lower price of gas in 1887 being increased to 8d. in 1901—the 6d. per 1000 feet which Sheffield has gained in the fifteen years compared with Nottingham.

Such are the facts. Were they inevitable? I think not. If there had been a change in the illuminating power of the gas at either place, the price paid for coal or the make of gas per ton would have been affected; but, looking through the returns in "Field," I find no relative difference. All through the fifteen years the Nottingham quality has stood at about 18½ candles, while Sheffield has been about a candle lower; consequently there is nothing here. One is driven to the conclusion that Sheffield has bought its coal much better than Nottingham, which is done through their General Manager and Secretary. Then one cannot but feel that there is no reason why the Nottingham make of gas per ton should not have been maintained at the level of 1887-8. I think, speaking generally, from what I saw, the retorts are not so hot as they should be for making a large quantity of gas per ton. Of course, it is possible that the coal now used does not yield so much gas as that in use fifteen years ago. If so, this will account for a part of the adverse difference. Or it may not produce such good coke; and, if so, the heat of the retorts cannot be so well maintained, and the consequence is a lower make of gas per ton. I think there may be something in the last point; for the proportion of cannel, which yields a very inferior coke, averaged 29 per cent. in 1887-8, and 36 per cent. in 1900-1. On the ground of coke alone, cannel should not be used unnecessarily. Its only use is to enrich ordinary coal gas, and it is undoubtedly the best enricher. But why enrich at all? Cannel not only produces very inferior coke, but the quantity of coke per ton is considerably less than from common coal. If, therefore, enrichment is unnecessary, cannel should not be used. I see that 12 candles is the prescribed standard for Nottingham gas, tested with the old 15-hole argand burner. This burner is reckoned as 2 candles inferior to the standard Sugg's "London" argand—that is, gas which only gives a light equal to 12 candles when the 15-hole argand is used gives with the standard "London" argand a light equal to 14 candles. Therefore, if by your burner 12 candles is shown in the photometer, that same gas would be shown to be of 14-candle power by the "London" standard. Why you have maintained so high a quality as 18 candles is beyond my comprehension. To do so, extensive enrichment is a necessity which is certainly not worth to the consumer what it costs him. The proper quality of gas that should be supplied in any locality is that which can be easily obtained from the nearest available supply of gas coal. To aim at any higher quality, richer coal must be obtained elsewhere at great additional expense, or cannel must be used (also expensive, and bad in other ways), or the gas must be enriched by benzol or petroleum spirit, or carburetted water gas must be used. Every one of these methods of adulterating the gas is objectionable and costly. Therefore if enrichment is not a necessity, it is folly to spend money upon it; and, moreover, all such mixtures are unsatisfactory. Happily, it has now been proved that all enrichment is a mistake; and Parliament has sanctioned reductions of illuminating power to the quality that can be obtained from the available supply of coal. There were those who feared that to reduce the illuminating power even 2 candles—from 16 to 14—would compel the consumers to use a far more than proportional increase in the quantity of gas. In 1900 this contention was put forward, and the question was fiercely contested by the London County Council in opposition to the South Metropolitan Company's Bill for a reduction of the standard from 16 to 14 candles. The Company gained the point—of course, agreeing to a rather more than equivalent reduction in the initial price of their gas—2d. per 1000 cubic feet, in fact. The quality was reduced in 1901, and no increase of consumption whatever has been found as a consequence of the lower quality. The Company undertook to supply free of cost burners suitable for the 14-candle gas, with the result that in innumerable cases the consumer now gets more light from the 14-candle gas than he formerly got with his old burners from 16-candle quality. Parliament in the past session sanctioned several similar reductions of illuminating power; and in other cases it has been reduced by the suppliers of gas. Corporations such as Nottingham, who were supplying a much higher quality than their Acts prescribed, have reduced it, as they had a perfect right to do; and no disadvantage has resulted to the consumers. The Engineer of the gas undertaking of an important Midland town told me they had reduced from 17 to 18 candles to 14 or 15—I forget the exact figures—and not only was it no disadvantage to the consumers, but, by entirely dispensing with cannel, the cost of making gas was considerably cheapened. In Glasgow, some years ago, there was a reduction of about 5 candles; and two years ago the Engineer stated at one of the gas engineers' meetings that none of the ills that were feared had happened, and that the consumers did not burn more gas in consequence. But the most convincing fact is that the London County Council, who so strenuously opposed the South Metropolitan Bill for a reduction above referred to in 1900, have given notice for a Bill of their own for the session of 1903; one of its chief provisions being to compel the Gaslight and Coke Company, supplying the northern side of the Thames, to reduce their standard from 16 to 14 candles.

The fact is, the nominal quality of the gas is of no importance. The consumer can get, within very wide limits, any candle power he pleases. It all depends on the burner and the method of burning. With the worst form of burner—very much used, I am sorry to say—not more than 6 or 8 (I might even say 5) candles can be got from 5 cubic feet of gas per hour; while the best ordinary burners give 15 or 16 candles for the same quantity. Then the Siemens and Wenham burners give 30 candles; but these are now all eclipsed, and practically rendered obsolete, by the incandescent mantle system of using gas. From 5 cubic feet of gas, 100 candles and more can readily be obtained; and it has actually been found that reducing the quality of the gas increases to some small extent the light given by the incandescent system. I have, therefore, no hesitation in recommending you to reduce your 18½-candle power gas to (say) 14½ candles. By so doing, you will materially reduce the cost of manufacture, and your consumers and the town generally will be benefited. This will enable you to entirely discontinue the use of cannel, which will greatly improve the coke, for which there will be a better market, and better prices will be obtained. It will also be unnecessary to purchase any of the expensive Yorkshire or other coal yielding gas of high illuminating power. Moreover, a larger quantity of gas will be obtained per ton of ordinary coal when the illuminating power is reduced; consequently, less coal will be used.

The purchase of coal is a duty of the first importance, for which the advice and assistance of a thoroughly capable expert is necessary. I am afraid I cannot say much for your present system, which is complicated, and rendered much more difficult by the supposed necessity of supplying 18-candle gas. A list of the contracts last made has been given to me at my request. There appear to be 25 separate contracts for 169,500 tons of coal and cannel; but three of them being both for ordinary coal and nuts, there are 22 different collieries engaged in supplying the works with coal. Five collieries in Derbyshire and ten in Yorkshire supplying ordinary coal, and seven supplying cannel, is a perfectly hopeless and bewildering mixture for your Engineers to deal with. For good regular working, the less variety or change of coal the better. One coal gives a good heating coke for the retorts, and another does the reverse; the result is irregular heats and bad working. Neither the managers, nor the foremen, nor the men can be blamed, for they simply cannot help it; and the successful working of inclined retorts is impossible. The contracts range from 35,000 tons down to 1500 tons; there are 20 under 10,000 tons. I should say that

to divide your orders between five or six collieries should be sufficient. One Derbyshire colliery last year sent 60,000 tons of first-class gas coal to a suburban London Company; and I see no reason why you should not make contracts for a similar quantity. I should say: "Get the best advice from a man of large experience in the use of Midland gas coal; ascertain which kinds are most suitable for your purpose, and endeavour to keep to them." There is only one good reason for a moderate number of coal contracts, and that is the wisdom of having several strings to your bow. I see in the contracts recently made there are 67,000 tons of Yorkshire coal, costing on an average 2s. 4d. per ton more than the 35,000 tons from Derbyshire. Why cannot all the coal required be obtained from Derby or Nottingham? To this question I cannot give a definite answer, because my experience in the use of Midland coal is very limited; but I should certainly try to get all the coal needed from the nearest collieries, and thus save, at any rate, something material in the railway carriage.

A few words as to management. If the Nottingham Gas-Works were in the hands of a company, and I were Chairman, I should keep the Engineer to the engineering and gas-managing side of the business, placing the commercial part in other hands, as at Sheffield. With so large a business as that at Nottingham, he would then have full occupation. I am sure that in many cases—I might say nearly all—boards of gas companies and gas committees of corporations have a very imperfect idea of the great variety and importance of the duties of the engineer of a large gas undertaking such as that at Nottingham. It is essential that the engineer should be in close and constant touch with the actual working and management of the works. This can only be done by the location of his office and staff at one of the manufacturing stations, preferably the largest, though this in your case may not be practicable, as Basford seemed to me rather out of the way. If Basford is out of the question, then another station must be selected; but let it be Basford if possible. My reason for laying so much stress on this point is, first, that if the Chief Engineer's headquarters and office are at George Street, he is practically divorced from the most important part of his work—viz., the direct management of the gas-works. He is out of touch with the working and management, and responsibility is divided, and thus practically destroyed. If the chief is the actual manager of one of the works, he will set a high standard of efficiency for the other stations to work up to. He will keep himself thoroughly acquainted with all the details of management, on which successful working very largely depends; whereas to locate him at George Street will cut him off from this and from all personal knowledge of the workmen—a very important matter in these days. It is very advantageous, from every point of view, that the Chief Engineer should spend as much time as possible actually on the works; but to locate him at George Street must reduce it to a minimum. He will, of course, have full charge of the distribution of the gas in the town. As to outside professional work, I would say that it has its advantages, for it enlarges experience, and so tends to make a more efficient officer; but it must on no account be allowed to interfere in any way with the proper and efficient discharge of the engineer's onerous duties. The future of the gas industry depends mainly on the engineers; therefore it behoves boards of directors and gas committees to have a right conception of the importance of the charge entrusted to their engineers, and to give them every encouragement.

P.S.—Unless the Chairman or some active member of the Gas Committee is an expert in gas engineering and management, which is very rarely the case either with gas boards or gas committees, the Committee are absolutely in the hands of their chief officers, particularly their engineers, who have the spending of large sums of money both on capital and revenue account. I have frequently said that the chairman of a gas company ought to be a gas expert, and able to form an opinion as to the wisdom and soundness of the advice and recommendations of the engineer. At Nottingham, a new Engineer has been appointed. I do not know him, or anything about his engineering capacity, or the work he has done. I have not the slightest objection to a young man being placed in a responsible position if he has the necessary capacity, knowledge, and experience—the last being an important qualification for the management of a large gas undertaking. How are the Committee, unless the Chairman is an expert, to know whether the advice of their chief officer is sound? I do not wish to suggest the contrary in the smallest degree, for I know nothing against the new Engineer; but the interests over which he has charge are too great to justify the running of any needless risks. In all questions of character, it is right to place confidence in a man, unless there is reason to believe him to be unworthy of confidence; but in matters of pure business, a man may justly and fairly be required to prove his capacity before being trusted with the absolute control of a great undertaking. In every case where I have had to give advice, and where I have found or have known the engineer or manager to be a capable man, I have always recommended his board or his committee to let him do all their work without a consulting engineer. I cannot make such a recommendation in your case, unless there is on your Committee a gas expert of large experience. If not, you certainly need, for a time at least, the assistance of a gas engineer, thoroughly acquainted, by practical working, with all modern developments in gas manufacture, and especially acquainted with all good gas coals in the Midland district. I am not speaking for myself, because I could not undertake the duty, and I have not the necessary acquaintance with Midland coal. These remarks will, I hope, be taken in the spirit in which they are written. I wish to see the Nottingham gas undertaking thoroughly prosperous, and again selling cheap gas. That is certainly possible, and, properly guided, satisfactory results and a satisfactory position are well within reach at no distant time; but it all depends on the management.

Mr. Brown's First Report (Nov. 1, 1902).

Gentlemen,—I have great pleasure in submitting to you my report on your gas undertaking, of which you have done me the honour of placing me in control as Engineer and General Manager. In my report you will find that I have taken each works separately, dealing with the condition and efficiency of the plant at each station.

Basford Gas-Works.

This is your largest station, and is capable of producing about 5½ million cubic feet of gas per diem. There are three retort-houses. No. 1, containing 12 beds of seven retorts each (168 mouthpieces), heated on the direct fire system. The cost of producing gas in this house is approximately 2s. 9½d. per ton of coal carbonized, with a consumption of about 24 lbs. of coke per 100 lbs. of coal carbonized. The whole of the coke produced in this house is dealt with by hand labour, and, consequently, working expenses are high. The condensers and foul mains are ample in size and in good working order. A portion of this house is in continual use as a coal-testing plant, from which very accurate and valuable information is obtained; the plant being well designed for this purpose.

No. 2 retort-house is of similar construction, but contains 28 beds of seven retorts each (392 mouthpieces), and is capable of producing about 2 million cubic feet of gas per diem. The cost of producing gas in this house is also about 2s. 9½d. per ton of coal, with a consumption of 24 lbs. of coke per 100 lbs. of coal carbonized. No coke-handling machinery is installed in connection with this house.

No. 3 retort-house is of more modern design. It contains 30 beds of eight retorts each, heated by regenerative furnaces; provision has also been made for the erection of a further 10 beds of eight retorts each. This house is equipped with modern and up-to-date machinery; and the retorts are drawn and charged by compressed air charging and drawing machinery. Coke conveyors, elevators, and storing and screening plant have also been installed, and are at work in connection wth 20 beds of retorts in this house. The coke-handling machinery for working the remaining 10 beds is only partly completed. The cost of producing gas in this house is considerably less than at any of the other stations, and it is my opinion that this plant ought to be by far the most economical plant to work. The cost of carbonizing is not more than 1s. 4d. per ton of coal carbonized, as compared with 1s. 9d. per ton at the Eastcroft works with inclined retorts (the next lowest). The consumption of fuel is also fairly low—viz., 12⅓ lbs. of coke per 100 lbs. of coal carbonized. The coal handling and charging machinery is of very good design, and in efficient working order, and, with the exception of the storage capacity of the coal-hoppers feeding the charging-machines, requires practically no alteration. The coke-handling plant is also of good design, and is in efficient working order. I regret, however, to say that the heating of these retorts is far from satisfactory, and, in fact, needs careful attention; and it is possible that the furnaces and settings may require reconstruction.

In the No. 1 and No. 2 retort-houses, the carbonizing wages and the fuel consumption are very high; but, owing to the good design of the furnaces and retort-settings, a fair yield of gas per ton of coal is obtained. But in the No. 3 house, although equipped with modern machinery and appliances, the make of gas per ton of coal is very low indeed; and, in fact, this reduced production of gas per ton of coal (owing to the faulty design and very probably the mismangement of the settings) to a very large extent counteracts the great saving effected by the use of modern machinery, &c.

The make of gas per ton of coal at these works for the last eight years has not been up to the average of the three works; and, owing to the very much larger quantity of gas being produced here, considerable loss must have been sustained from this cause alone during this period.

Below I append a statement (A) giving the gas made per ton at the three stations during the last nine years, also one (B) giving the amount of coal carbonized and gas made per ton at each station from Jan. 1 to Sept. 30, 1902.

Statement A.

Date.	Eastcroft.	Radford.	Basford.	Total.
	Cubic Feet.	Cubic Feet.	Cubic Feet.	Cubic Feet.
March 31, 1894 . .	10,292	10,100	10,191	10,194
,, ,, 1895 . .	10,573	10,323	10,406	10,444
,, ,, 1896 . .	10,690	10,316	10,231	10,392
,, ,, 1897 . .	10,623	10,365	10,445	10,490
,, ,, 1898 . .	10,634	10,309	10,276	10,405
,, ,, 1899 . .	10,623	10,075	10,157	10,273
,, ,, 1900 . .	10,332	10,194	9,853	10,046
Inclines Installed.				
March 31, 1901 . .	9,565	9,783	9,738	9,677
,, ,, 1902 . .	10,026	10,232	9,700	9,880
Average	10,373	10,189	10,111	10,200

Remarks.—Radford was shut down from June 4, 1900, to Oct. 7, 1900, inclusive also from May 31, 1901, to Sept. 29, 1901, inclusive.

Statement B.

Station.	Coal Carbonized.	Gas Made.	Per Ton of Coal.
	Tons.	Cubic Feet.	Cubic Feet.
Eastcroft	49,540	511,468,000	10,324
Radford	10,150	101,985,000	10,048
Basford	77,485	741,361,000	9,568

From the Statement B it will be seen that if Basford had produced the same amount of gas per ton of coal as Eastcroft, Basford would have made 58,578,000 cubic feet more gas from the coals carbonized, which is, in other words, a difference equivalent to a loss of over 5000 tons of coal in nine months' working. This difference of 756 cubic feet of gas per ton of coal between the two works using the same coals is a very large amount; and I cannot believe that the whole of this difference is caused by the faulty design of the settings, especially seeing that previous years have not shown anything approaching to so great a difference. I am of opinion that the whole cause cannot be ascertained without long and close observation. I can, however, state, from personal observation, that the management of the carbonizing plant at Basford is not by any means satisfactory. This figure of 756 cubic feet of gas per ton of coal is greater than any difference I can find

for any similar previous period. The make of gas per ton at Basford has, however, for the last eight years (with the exception of 1901) been considerably below the Eastcroft figure.

The next greatest difference is about 500 cubic feet of gas per ton in 1899, and at a cost of 2d. per 100 cubic feet of gas for coal and labour, this reduced make, or loss of gas, per ton is equal to 10d. per ton of coal carbonized; but, owing to the cost of carbonizing in the machine-worked retort-house being 1s. 1d. (13 pence)—these figures are taken from the 1902 balance-sheet—per ton below the average total cost of carbonizing at the three stations taken together, and seeing that the fuel consumption is also about 9d. per ton of coal less with the re generative furnaces than with the direct-fired retorts, it is still more economical to work this house than the hand-fired retorts. But, seeing that by far the greater portion of the coals are carbonized at these works (104,000 tons out of a total of 196,000 tons for 1902), it is of the greatest importance that this matter should have immediate attention; and I recommend that steps be taken to divide this work into sections, so that the gas made in each house may be dealt with separately until after it is measured in the station meters, in order that exact and precise information can be obtained as to the working of the plant in each house. It is usual in works of this size to separate the producing plant into sections, both for safety in case of accident or breakdown, and for efficiency in working; and I am much surprised that this has not already been done at the Basford station.

The "lay-out" of the mains on the works is most complicated. Extension after extension appears to have been carried out from time to time without any complete rearrangement of the existing plant. The result is that the connections are in such a mixed state as to make efficient working very difficult; while plant that would not be tolerated on even small works has been retained and kept in use without any regard to economy in working. Dividing the works into sections will, of course, necessitate the alterations of these mains; and the plant will then be capable of being worked on thoroughly efficient lines.

The condensers are very small, and extensions will shortly be necessary. There are in all ten boilers—seven 28 ft. by 7 ft., and three 18 ft. by 5½ ft. This portion of the plant is not of the best design, and provision for extensions will probably have to be made in the near future. In the meantime, a steam-condensing plant should be erected if possible, to utilize the large quantity of exhaust steam emitted from the engines at work, and so increase the efficiency and power of the engines and considerably reduce the quantity of steam required from the boilers. The exhausting plant is of ample capacity to meet all present requirements. The purifiers are in seven separate sets, and scattered over the works. Many of them are small and inconvenient in working. The new extensions now in hand will not be completed ready for work this season, and further extensions will probably be required for the 1903 winter season.

The station meters are of sufficient size to deal with all gas made at present. The gasholders are seven in number, and are barely sufficient to meet the requirements of the works; and extensions will shortly have to be commenced, seeing that it will require three years to complete the erection of a new holder. With the present annual increase, additional storage capacity will very shortly be necessary.

The governors are of ample capacity, and in efficient working order.

Generally the works can be said to be of good design, substantially built, and well laid out; but many slight alterations require to be carried out in the immediate future to bring them up to date, and to make the working and supervision of the plant more effective. The railway connections and sidings are very convenient, and the cost of handling coal and material is consequently low. But, on the whole, considering that such a large quantity of gas is made at this station, the results obtained are far from satisfactory; and, with energetic management, and the carbonizing plant brought up to date, considerable improvement ought to be shown on these works.

Eastcroft.

This station has recently been remodelled, and contains modern and up-to-date plant. No. 1 retort-house contains 16 beds of eight retorts, heated with regenerative furnaces, and capable of producing 1,400,000 cubic feet of gas per diem. The fuel consumption is low—13 lbs. per 100 lbs. of coal carbonized; but the cost of producing gas is 2s. 10d. per ton of coal, the stoking and coal and coke handling being all done by manual labour.

No. 2 retort-house contains 16 beds of inclined retorts, equipped with coal-handling plant and coke conveying, elevating, screening, storing, and loading machinery. The whole arrangement is of very good design, and mechanically very complete. The fuel consumption is low—13 lbs. per 100 lbs. of coal carbonized; and carbonizing costs about 1s. 9d. per ton of coal. Here, again, I regret to say, the heating of the retorts is irregular and unsatisfactory, and since this new plant was installed, the make of gas per ton of coal appears to have fallen off to a certain extent, although during the current year, since alterations have been made in the settings, much better results have been obtained. (See Statement B.) For some time past, however, one half of this house has been working with eight-hour charges, as against five-hour charges in No. 1 retort-house, resulting from the defective heating of the retorts. Owing, however, to the gas from these two retort-houses being dealt with together, it is impossible to obtain accurate figures as to the comparative working result.

The condensers are of ample capacity. The boilers and exhausters are modern and up to date, and quite sufficient for the work required from them. The washers and scrubbers are not capable of dealing efficiently with the quantity of gas made; and on many occasions the percentage of ammonia in the gas is found to be very high. Not only is this valuable product wasted, but, what is of more consequence, the working and efficiency of the oxide is greatly impaired. It is advisable that a second washer-scrubber should be erected at an early date to remedy this serious defect. The purifiers are in two sections, and appear to be equal to the work required of them. One set is of modern and up-to-date design, and is quite capable of dealing efficiently and economically with all the gas produced in the larger retort-house. The smaller set is of much older design, inefficient, and not economical in working.

The station meters and governors are of ample capacity. There are four gasholders, which have recently been reconstructed.

The works generally are of very good design and substantially built. The facilities for dealing with coal, coke, and residuals are very good; and there is apparently no reason why good results should not be obtained at these works. As in the case of Basford, I strongly recommend that the plant be divided into two sections, for safety and economy in working; and, owing to the distribution of the plant, the works lend themselves readily to the adoption of this scheme.

In the design of the new plant, provision has been made for the reconstruction of the No. 1 retort-house on the same lines as No. 2; and should the alteration be carried out, the maximum productive capacity of this station would then be reached, and no further extension of the coal-gas producing plant would be possible. If it should be necessary to work the No. 1 retort-house continualy, I should strongly recommend that this house be reconstructed on modern lines, as the saving effected by up-to-date plant would more than pay interest on the capital outlay, besides increasing the productive capacity of the station very considerably.

Radford.

This is the smallest station, and contains the oldest plant. There are two retort-houses—No. 1 containing 10 beds of seven retorts each, capable of producing about 700,000 cubic feet of gas per diem; No. 2 containing 17 beds of seven retorts each, capable of producing 1,300,000 cubic feet of gas per diem. The cost of carbonizing is about 3s. per ton of coal, and the fuel consumption is not less than 25 lbs. of fuel per 100 lbs. of coal carbonized. The whole of the coal and coke handling is done by hand labour, and consequently carbonizing costs are high at this station.

The condensers, exhausters, washers, boilers, &c., are of ample capacity, and easily capable of dealing with their work. The purifiers are very small in size, and not economical in working, but are capable of dealing with the maximum make of gas at the station. The station meter and governors, &c., are also of ample capacity and of modern design. There are five gasholders, four of which are of very small capacity, and most inconvenient in working.

It has, I believe, been the custom for the last few years to close this station for several months in the summer time, owing, no doubt, to the two larger stations being able to produce gas much more economically, and to the plant at Radford being small and antiquated, and therefore to a certain extent risky in working. Owing to the heavy fuel consumption in the retort-furnaces, and the high cost of carbonizing, it cannot be advisable to work this station except in winter time, when absolutely necessary in order to relieve the other two stations. When the increased consumption makes it necessary for this station to be more continually at work, it will be found advisable for the plant to be remodelled and put under good and efficient management, in order to meet the increased demand for gas. The design of the plant and of the mains in the works is very old and out of date; and the method of emptying and filling the holders is also very crude.

Taken together, the three stations have a total maximum producing capacity of about 9,000,000 cubic feet of gas per diem; the total storage or holder capacity is 9,700,000 cubic feet; the total maximum daily consumption is 10,060,000 cubic feet; and the total maximum daily production is 8,876,000 cubic feet. From these figures it will be noticed that the total holder capacity is at present not equal to one day's maximum consumption, although the storage capacity of the undertaking has been increased by remodelling and enlarging, by the addition of wire-rope lifts, the gasholders at the Eastcroft station; and if the output continues to increase at the present rate, additional storage will very shortly be required. The construction of a gasholder will occupy at least two years; and by the end of that time it will, in all probability, be found advisable to discontinue the use of the four diminutive holders at the Radford station.

Giltbrook Chemical Works.

The plant at Giltbrook is generally of good construction and fairly economical in working. The tar-distillation plant is capable of dealing, on economical lines, with a much greater quantity than at present is produced at the three gas-stations. I am, however, of opinion that the treatment of the tar products should, in the case of the first runnings and light oils, be taken one stage farther, and benzol, toluol, and solvent naphtha produced from these products. The whole of the first runnings and light oils are at present sold for the London markets; and I have no doubt that on many occasions the carriage and freight expenses have been equal to almost 50 per cent. of the price obtained for the goods.

[Mr. Brown offered some observations on the plant; adding that there are very few corporations or gas companies owning such a complete chemical works as those at Nottingham.]

General Remarks.

Generally the plant is well built and of a substantial character; and the different stations are of good design, and conveniently situated as regards coal and residuals. Alterations and improvements have, however, been carried out in small portions; and inefficient plant is at present in daily work side by side with the most modern and efficient. So that, while there is modern and up-to-date plant on all the stations, no one station can be said to be thoroughly up to date.

At Basford, the compressed air machinery is working in the No. 3 retort-house; but in No. 1 and No. 2 retort-houses old-fashioned and inefficient plant is still in daily use. Eastcroft is fairly well up to date; but up to the present the new inclined retorts have not been very successful. The Radford station contains the oldest plant; and, considering the plant they have to use, most satisfactory results are obtained.

With the exception of No. 1 retort-house at Eastcroft, none of the modern furnaces appear to give satisfactory results; and, owing to the fact that the gas from the various retort-houses is always taken together, it is very difficult to obtain reliable and accurate results as to the working of any particular section. The mechanical part of the plant in No. 2 retort-house at Eastcroft (inclines) and the No. 3 retort

house at Basford (compressed air plant) is really all that could be desired; but, unfortunately, the working of the furnaces appears to make it impossible for good results to be obtained.

I should strongly recommend, as a preliminary step, that the No. 3 retort-house at Basford should be completed by the erection of further beds of retorts, heated by regenerative furnaces, because I am firmly of opinion that this class of plant—viz., stoking machinery and horizontal retorts, heated by regenerative furnaces—if well designed and properly managed, and worked on a sufficiently large scale, will give the most satisfactory results. This extension should, in my opinion, take place almost immediately, so that some of the inefficient plant now in daily operation could be thrown out of work as soon as possible.

It will, in my opinion, be found advisable to extend Basford, and to make it the chief station, seeing that in every way it is the most suitable. Should this course be adopted, stoking machinery and regenerative furnaces should be installed in the No. 2 retort-house, making the two houses quite distinct from each other up to the station meters. The direct-fired retorts at Basford and Radford should be worked as little as possible, and then only in cases of emergency; and all plant that it is required to work throughout the twelve months of the year should be of modern and good design. The Eastcroft plant should be divided into sections for economy and efficiency in working.

I may add that the carbonizing department is by far the most important branch of the undertaking. The old axiom that "profits are made in the retort-house" is as true as ever; and while it is necessary to have thoroughly efficient and up-to-date plant, it is of the very utmost and most vital importance that the superintendents at each station should be good up-to-date carbonizers, and have a perfect knowledge of the details of working and construction of the retort-houses and furnaces, &c., under their charge. The sulphate of ammonia plant at Basford should be remodelled and extended, so that the whole of the ammoniacal liquor could be dealt with there instead of at Giltbrook. The sulphate plate at Giltbrook should be shut down, and the plant generally extended and brought well up to date.

These alterations will involve a large amount of detail work, and it is imperative that I should have additional assistance in the drawing office, in order to prepare the necessary drawings and specifications.

[The remainder of the report is devoted to observations on the distribution, clerical, and other departments. Among the matters to which the attention of the Committee is called is the illuminating power of Nottingham gas, which is 18½ candles. Mr. Brown points out that the future of coal gas must lie to a very large extent in the direction of heating and power rather that lighting; and he therefore recommends that the standard should be reduced to 17, and subsequently to 15 candles, the effect of which would, he says, be a large reduction on the cost to produce, which would enable the Committee to lower the price. On the subject of the purchase of coal by tender, Mr. Brown characterizes as most unsatisfactory the contracts at present running for the supply of more than twenty different kinds of coal; and he strongly recommends the Committee to empower the Chairman, with his assistance, to purchase in the open market all the coal required.]

Mr. Brown's Supplementary Report (Feb. 4, 1903).

To the Chairman and Members of the Corporation Gas Committee, City of Nottingham.

Gentlemen,—I thank you for the opportunity of modifying some of the statements contained in my report, which, as you are aware, was made within four weeks of my appointment. I have now been in close touch with the undertaking for nearly five months, and have had opportunity for close investigation into several matters; and have, as you will readily understand, seen occasion to modify some of my opinions in one or two instances.

In the case of the regenerative furnaces in the No. 3 house at Basford, however, I am convinced that the poor results are very largely due to the faulty design of the bench ironwork in connection with No. 1 section, and in some measure to the management of the carbonizing. I am sure these causes contribute to a very great extent to the very poor carbonizing results at this place. I have, since the date of my last report, made a slight rearrangement of the retorts, and have been able to work the Basford plant in two sections. Sufficient time, however, has not yet elapsed to obtain reliable and accurate information, so that I could place anything definite before you; but I may state that greatly improved results have already been shown at these works.

Since obtaining precise information as to the "lay-out" of the mains at the Basford station, I find that they are not quite so complicated as I was at first led to suppose. They are, however, far from satisfactory. No extension of the purifying plant will be needed for the 1903 season; but a new station meter will shortly be required. With reference to the inclined retorts at Eastcroft, I find the low make per ton with this plant is mainly due to the fact that in building this installation the then existing horizontal furnaces (10-feet single ended) were reconstructed and utilized for the new inclined retorts (20-feet double-ended). These furnaces are very much too small, and are consequently unable to produce the necessary heat for the proper working of the plant. Since October last, I have been carefully selecting suitable coals for use in these inclined retorts, and already greatly improved results have been obtained.

Although the storage capacity of the undertaking is not equal to the maximum day's consumption, I now find that, owing to the uniformity of the demand, with careful management, no new gasholder need be erected for some time. In fact, I am of opinion that, with the present annual increase, no large expenditure on producing plant will be required for several years.

With respect to any comparisons of Sheffield and Leicester with Nottingham, it is only fair to point out that your Gas Department covers an enormously large area (133 square miles), while the districts of supply in Sheffield and Leicester are very compact and densely populated; and yet, in spite of the increase in the consumption of gas in the last fifteen years being 100 per cent. in Leicester, against 38½ per cent. in Nottingham, and also the further fact that Leicester has increased its productive capacity by the erection of a 3 million cubic feet per diem water-gas plant (one-third of Nottingham's total capacity)—which plant can be erected at less than one-half the capital outlay required for the equivalent in coal-gas plant—Nottingham's capital outlay per 1000 cubic feet of gas sold is practically the same as Leicester's in this respect. In considering this figure, it must be remembered that Nottingham has a large reserve in producing power, and could meet a 20 per cent. increase with practically very little capital expenditure.

Taking the last three years, Leicester has increased its consumption by 23 per cent. against Nottingham's 10 per cent.; Leicester's capital outlay has increased 12 per cent. against Nottingham's 8, which would be reduced to 6 per cent. if allowance were made for the expenditure on mains caused by the erection of the new electric tramway. Taking Sheffield, during the last three years the increase in consumption has been met by a capital outlay of £101 per million, which, unless under some very special circumstances, would be an utterly impossible figure if everything is fairly charged to capital account. The adoption of slot meters, cooking-stoves, and the extension of labour-saving appliances have also increased the capital outlay per 1000 cubic feet in Nottingham.

With regard to the inclined retorts at Eastcroft, I may say that I have for some time past been using selected coals which from my own personal experience were suitable for the inclined retorts; and as to "creeping coals," I would say that this has also been very largely due to the poor heats obtained in the settings. If my recommendations are carried out, and the plant is divided into two sections, an efficient check can always be maintained on the working of it generally, and you will then be able to ascertain, by practical experience, whether or not it will be to your advantage to erect future extensions on the horizontal or the inclined system.

As to the sale of residuals, I have all my life been closely associated with the sale of tar, ammoniacal, and chemical products, and would respectfully venture to say that, although good results have been obtained in the past so far as the sale of your products is concerned, yet I am hopeful that, having direct control of your Giltbrook works, my special experience and technical knowledge of these matters will enable me to show even better results in the future.

The great difference latterly in the price for coal paid by Nottingham and Sheffield can be largely accounted for by the following facts: (1) Nottingham supplying nearly an average 1½ candle higher gas than Sheffield. (2) Sheffield is situated in the immediate vicinity of the coalfields, and can use a medium or poor quality of any of its local coal. Nottinghamshire and Derbyshire coals produce a gas of low candle power; consequently, Nottingham has been compelled to buy a large quantity of high quality coal from the Sheffield and Barnsley districts, in order to maintain the high candle power supplied. (3) In Nottingham the staple industry is lace; in Sheffield it is the iron trade, and, consequently, Sheffield has an enormous demand for gas coke of almost any quality. In Nottingham the field for coke is very limited, and markets have to be found at very long distances; and the only way to provide an outlet for Nottingham coke has been found by purchasing coals which produce the highest quality coke, and putting it on the market washed and screened by machinery. The Committee will appreciate this better when I state that Nottingham coke has on many occasions fetched a higher figure in Birmingham than Birmingham coke. (4) The rate to London from the Derbyshire and Nottinghamshire and South Yorkshire coalfields has, within the last few years, been made practically identically the same; but Nottingham has to pay not less than a 2s. 1d. rate on all the South Yorkshire coals used. Consequently, South Yorkshire coals have lately obtained a relatively higher price in the London markets. The use of Nottinghamshire and Derbyshire coals and the supply of a high candle power gas have also necessitated carbonizing 40 per cent. of cannel. This local coal and cannel produce, on an average, 700 cubic feet of gas less per ton than South Yorkshire coal, and the coke produced from these coals is very deficient in heating value; and I can state with confidence that during the last few years the yield per ton from almost every class of coal has considerably decreased. Bringing Leicester again into the comparison, although Leicester is equally favourably situated as regards the coalfields as Nottingham, the average for the last fifteen years shows 1s. 5d. per ton in favour of Nottingham, and yet recently Leicester has been supplying a 15½-candle gas. The Gas Committee possess a record of results of very accurate practical working tests of every gas coal within a radius of from 50 to 60 miles of the Nottingham Gas-Works, and from the information in their possession they are in a position to accurately determine the commercial value of any coal that is offered to them. I may safely say that there is no corporation, company, or private individual possessing such valuable information as to the possible supplies of coal to Nottingham; and I am sure, if the coals are purchased by your Chairman, as suggested, the Committee will be able to obtain coal at the lowest possible figure.

I sincerely hope—and, indeed, feel quite confident—that when the returns for the current financial year are laid before the Council, the Gas Committee will feel fully assured that their judgment has not been at fault, nor has their confidence in me been misplaced.

Gas Workers in the Provinces.—But few more county volumes of the 1901 census now remain to be published. The last to appear are for Salop, Pembroke, Westmoreland, Merioneth, Huntingdon, and Brecknock, in which are enumerated 194, 32, 53, 17, 25, and 16 persons respectively described as gas workers.

Ratepayers to Pay for Public Lighting at Brighouse.—At last Wednesday's meeting of the Brighouse Town Council, Mr. Wainwright, the Vice-Chairman of the Gas Committee, stated that the Committee had decided that the cost of lighting the public streets should not come out of the gas fund, as hitherto, but should devolve upon the Highways Department. This was a radical change in policy, as the Council would see when he told them that since 1894 the cost to the Gas Department for lighting the public streets had been about £17,000. It was proposed that the change should take effect in about twelve months' time.

CROYDON COMMERCIAL GAS COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held on Friday, at the Public Hall, Croydon—Mr. CHARLES HUSSEY, J.P., in the chair.

The ACTING SECRETARY (Mr. E. Anderson) having read the notice calling the meeting, it was agreed to take as read the Directors' report and the accounts.

The CHAIRMAN, in moving their adoption, said those proprietors who had stock in other companies, would be aware that the past half year had not been a first-rate one so far as gas-making was concerned. The weather had been exceptionally mild. There had been very few, or scarcely any, fogs; and there had been an unfortunate depression in trade. But he thought very few companies could show a more satisfactory increase in the consumption of gas than they could. During the half year, the increase had been at the rate of nearly 8½ per cent.; in quantity, 33 million cubic feet; and in money, £1428. There had been added to their books 931 new consumers, and 620 stoves on hire. This showed that the steady progress they had enjoyed for many years past was being maintained. The Directors realized that the continuance of the prosperity of the Company would be best secured by offering to the consumers every facility for applying gas to all purposes, whether heating, cooking, or lighting; and it was owing to this conviction that new premises had been acquired at Purley, in which a show-room would be opened. Arrangements had also been made for Miss Ball to give weekly lectures and instruction in the use of gas-stoves, and to attend the houses of those consumers who might desire it to give information as to the best methods to obtain the highest result from the use of gas cookers and other appliances. They had also arranged with some of the best makers to give an exhibition in Croydon for a week from April 27. The system under which the Company undertook the maintenance of incandescent burners had proved very successful; and the consumers who had taken advantage of the system expressed their satisfaction with it. They had now 1500 incandescent burners being looked after by their men. This was a new departure for the Company; but he believed it was the right step. The new plant at the works, to which reference was made in the last two reports, had now been practically completed; and most of it was in good working order. It was anticipated that by its use the Company would secure some appreciable economies in the cost of production, and in dealing with certain residuals. The Directors, believing the proprietors would appreciate an opportunity of seeing the new plant at work, had suggested in the report that the next half-yearly meeting should be held at the works at Waddon. The Board regretted that, during the past two months, their Secretary (Mr. W. W. Topley) had been very unwell, and unable to attend to his duties. Under these circumstances, the Directors had granted him leave of absence; and they trusted he would shortly be able to return to his work with renewed energy. Commenting next upon the accounts, the Chairman said that £16,505 of additional capital had been raised during the half year; making the total receipts on capital account £439,573, which, however, was £8412 less than the amount of the total expenditure. In other words, they had spent £8412 of capital more than they had raised. For an ordinary individual in business, this would be an unwise thing to do. In their own case, however, they had only to put capital on the market to obtain it; but the Directors did not think it prudent to do this in large amounts at a time. It had been proved to them over and over again that, by putting the stock on the market in moderate amounts, a better price was realized. When a favourable opportunity came, they would place more stock on the market. He did not think there would be any doubt in the minds of the proprietors as to the expediency of making, as they had done, the final call on the Carshalton shares. The amount—£2 per share—had been received; and the Directors now recommended that the shares should be converted into consolidated "C" ordinary stock. The other side of the capital account showed that £17,938 had been expended, the principal portion of which, £13,161, was spent on new buildings and machinery. He might mention a few of the principal items. A water-tank and roofing to the new buildings had cost £817; but their Engineer and General Manager (Mr. J. W. Helps) believed that by means of this large tank and the storage it would afford, they would be able to save about £200 per annum. If they could do this, the £817 would prove to be money well spent. On the extensions in one of the retort-houses, railway docks, &c., the outlay had been £615. The railway dock had been extended so as to increase its usefulness, and to get nearer No. 3 retort-house, by which means they would be able to put the residuals into railway trucks at much less expense than under the old system. They had expended on West's compressed-air stoking machinery £1498; and on a compressor and boiler-house necessary for "raising the wind" or the air to drive the stoking machinery, £1300. On new boilers, steam pipes, &c., £2030 had been spent. Then there had been an expenditure of £3430 on coke-conveying plant. They were now able to take the coal out of store, feed the retorts, withdraw the coke, and load it into waggons without touching it anywhere by hand. As this conveying plant had proved very satisfactory in working, not only in other places, but since they had had it in use at Waddon, the Board hoped it would also prove to their Engineer a very great source of saving in regard to labour. Various parts of the work connected with the extensions had been carried out by the Company's own men; and the cost of this, with other items, came to £1790. A sum of £1125 had also been spent on the purchase and partial fitting up of the new show-room at Purley. He need hardly mention that these sums were merely the proportion spent during the half year of the total cost. The remainder of the capital expenditure was in connection with the outdoor department, and was a satisfactory sign of progress in that direction. As to the revenue account, the amount realized by the sale of gas showed an increase of £1428 over the corresponding period of 1901; and this would have been increased by nearly £3500 if the price of gas during the half year had remained the same as it was twelve months ago. This must be considered highly satisfactory. The Directors reduced the price of gas by 2d. per 1000 cubic feet in the Lady-day quarter of last year. They did this as soon as they possibly could; and at all times they would do so, as they believed in making gas popular. The increase (£511) in the amount received as rental of meters, gas stoves, fittings, &c., was very satisfactory. Generally speaking, too, the results under the head of residual products were also gratifying, excepting in regard to coke. The quantity made was more than was produced during the corresponding period of 1901; and the principal reason for the reduced amount received for it was that, during the whole of last half year, owing to the preparations for the introduction of machinery, Nos. 1 and 2 retort-houses had been in continual use. These houses were fitted with the old-fashioned direct-fired settings, and so the amount of coke used as fuel was much larger than was required in No. 3 retort-house, in which the settings were on the regenerative principle. On the other hand, the amounts received from tar and sulphate of ammonia were highly satisfactory; the increase being due to improvements in the market values. The total receipts for the half year exceeded those for the corresponding half of 1901 by nearly £2900. On the expenditure side of the account, it would be found that, notwithstanding the fact that 1430 tons of coal and 52,100 gallons of oil more had been used, the amount expended under this head was £1534 less than in the previous half year, which was due to the Directors having been enabled to purchase these materials at a somewhat lower price than prevailed twelve months ago. The Directors had lately entered into a contract for oil at a much lower price; and they trusted that coal would also fall in proportion. Among other items referred to was an amount of £7838 spent on repairs, maintenance of works, &c., which exceeded the figure for the corresponding half year by about £2300. This was due to the fact that the Directors had not hesitated to charge to the revenue account all items that could be properly so charged in connection with the large amount of alteration and extension at the works. Public lighting showed a decided increase; and this was owing to the Directors having some time ago made an offer to the Local Authorities, both in Croydon and the outskirts, to fit up with incandescent burners the public lamps not hitherto dealt with, and to forego the extra charge of 4s. 6d. per lamp on the lamps previously fitted with incandescent burners. This had cost them a loss of £450 in revenue. The outcome was that, although they had made these great extensions at the works, they had been able to nearly earn their dividend. In his opinion, their balance-sheet compared most favourably with those of other gas companies.

The DEPUTY-CHAIRMAN (Mr. Thomas Rigby) seconded the motion, which was unanimously adopted.

Mr. CORBET WOODALL, in moving the declaration of dividends at the rate of 14 per cent. per annum on the consolidated "A" ordinary stock, 11 per cent. on the "B" stock, and 9 per cent. on the "C" stock and Carshalton capital shares, said the satisfaction he felt was hardly diminished by the fact that they had not earned the dividend they were dividing by some £800. The Chairman had so fully explained to the shareholders the policy of the Board, that it was scarcely necessary to add a word; but he (Mr. Woodall) and his colleagues were all of one mind in the matter. He rejoiced that the Board had the courage to make a reduction in the price of gas even though they knew they ran some risk, of not earning, in the first year after the reduction was made, the full amount of the dividend. They had, however, considerable reserves which were available to make up any deficiency of this sort; and upon these reserves they had only to call to the extent of £800. It must be borne in mind that, as compared with the corresponding half of last year (when they did earn the dividend, and had, he thought, £100 to the good), they had given a reduction to the consumers of about £3800, and had spent something like £3000 more upon the works in the way of special and extraordinary renewals. These sums far outweighed the small deficiency they had to face. On the question of the desirability of keeping down the capital account, he said that any alterations that were mere alterations had been consistently charged to revenue, and always would be so—not a penny had been added to capital account for works other than the absolute additions to the value of the plant. The effect of this was well shown in a few figures he would give. In 1882, the quantity of gas sold was 263 million cubic feet; in 1902, it was 848 millions. There had thus been an increase in 20 years of 222 per cent. in the business. In the same time there had been an increase in the capital from £199,000 to £448,000, representing 125 per cent.; so that they had increased the business by 222 per cent. with an expenditure of only 125 per cent. The effect of this was seen in the cost of the dividend. In 1882, the dividend cost 17¾d. per 1000 cubic feet of gas sold; ten years later, it had fallen to 12d.; in 1901, it was 9·85d.; and in 1902, it was just 9¾d. As compared with twenty years ago, there had been a saving to the consumers of gas of nearly 50 per cent.—that was to say, whereas they had to take from the consumers nearly 18d. per 1000 cubic feet in 1882 for the payment of dividend, they had only to take now 9¾d. for the same purpose. At the present time, the capital represented £530 per million cubic feet of gas sold; and during the twenty years to which he had been referring, the increased business had been got at an expenditure of only £425 per million. So this was another way of illustrating the fact that their growing business had been obtained at a decreasing rate of cost. This showed that through the period named the expenditure of capital had been watched with great care; and he knew no way in which a board of directors could better serve both shareholders and consumers than by keeping a careful watch upon this particular item. It was necessary to remember that, during the period he had taken for comparison, the items upon which the Company had needed to spend money had materially increased. It was in that period they had taken, for instance, to the hiring out of stoves for cooking and heating. In the same period, too, they had taken in hand the introduction of prepayment meters, and the fitting up without charge of fittings in consumers' houses. In the last ten years, they had spent upon these items (excepting meters) a net sum—after allowing for depreciation, which had been written off from year to year—of £28,000. In addition to this, the cost of building and equipping gas-works now was greater than it used to be, because, while mechanical appliances for lifting and carrying coal and coke, and for charging and discharging retorts, did lead to economy in work, they meant a very considerable expenditure in money.

Therefore, looking at the position all round, he thought it was eminently satisfactory to be able to give such a statement of diminution in the rate of expenditure upon capital and in the cost of dividend while they had had these heavy charges to meet. In view of these circumstances, one could look with an easy mind on the slight deficiency in the profits that he had referred to.

Mr. SAMUEL SPENCER seconded the motion, which was unanimously agreed to.

On the motion of the CHAIRMAN, seconded by the DEPUTY-CHAIRMAN, a resolution was passed to the effect that the 2500 ordinary £10 fully-paid shares, issued under the Carshalton Gas Act, 1877, and the Croydon Gas Act, 1894, be consolidated and converted into consolidated "C" ordinary stock, having the same standard dividend as the said ordinary shares.

Subsequently the Chairman and Directors and the Engineer and General Manager (Mr. J. W. Helps), the Secretary (Mr. W. W. Topley), and their respective staffs were heartily thanked for their devoted services.

JUBILEE OF THE BRISTOL GAS COMPANY.

Remarkable Progress.

The One Hundredth Half-Yearly General Meeting of this Company was held at the Offices, Canons' Marsh, Bristol, last Thursday—Mr. J. W. S. DIX in the chair.

The SECRETARY (Mr. J. Phillips) having read the notice convening the meeting, the report and accounts for the six months ending the 31st of December last were presented. It was stated in the former that the revenue from the sale of gas showed an increase of 5·7 per cent. compared with the corresponding period of 1901, while the profit balance was £19,167 more. The accounts presented showed a profit of £41,898 for the half year, which was made up to £44,728 by the balance brought forward. After payment of the interest on the debenture stock and carrying £4707 to the reserve fund, in restitution of the amount withdrawn in December, 1901, the Directors recommended the payment out of the balance of a dividend at the rate of 5 per cent. per annum.

The CHAIRMAN, in moving the adoption of the report and accounts, said this year was the jubilee of the formation of the Company; and the Directors thought they could not do better to recognize this than place the consumers in the outlying districts on the same footing as those within the old city; so that all ordinary consumers of gas were now treated alike, having to pay 2s. 3d. per 1000 cubic feet for gas for household purposes, and 2s. 1d. for that used for motive power. Having dealt at length with the satisfactory nature of the balance-sheet, he remarked that a few words dealing with the history of the Company might prove interesting. The Bristol Gas Lighting Company (St. Philip's) was incorporated in 1819; the Bristol and Clifton Oil Gas Company, in 1823. In 1836 power was taken to use coal, and in 1847 the name was altered to the Bristol and Clifton Gas-light Company. In 1853 the two Companies amalgamated, under the style of the Bristol United Gas Company; and in 1891 the name was altered to the Bristol Gas Company. In 1852 the make of gas was 190 million cubic feet; in 1862 it had reached 389 millions; and in successive periods of ten years the make had progressed as follows: 1872, 634 millions; 1882, 1010 millions; 1892, 1658 millions; and 1902, 2285 millions. In 1862 the capital expended was £255,388, and up to 1902 it had reached £1,158,814; while the reserve fund had increased from £15,287 in 1862 to £106,470. In 1893 the Bristol Corporation commenced supplying electricity, and since that time he was happy to say, strange as it might appear, the Company had progressed and prospered. Electricity was, it was said, going to extinguish gas altogether; but its introduction had led to a much greater increase. Railway companies and other large undertakings complained that their profits were cut into greatly by rates and taxes, and that the increase yearly of their assessments had become a very serious matter. In 1862 the Company contributed £1294 to the city rates; but this had steadily increased until it reached the large sum of £8962 (1902), which was nearly 1¼d. in the pound of the entire rate. While the Company had prospered, it could not be said that they had not looked after the interests of the consumers. In 1852 the selling price of gas was 4s. 6d. per 1000 cubic feet, and this had been gradually decreased, until to-day it was only 2s. 3d. There were few companies who sold at so low a rate as 2s. 3d. to the ordinary consumer, and they had reduced the price for motive power to 2s. 1d., whether a million feet were used or not. This, he thought, would be of great assistance to traders who had light machinery. The cookers let out by the Company had greatly increased in number; and all housewives who had tried them were loud in their praise. In 1892, 2196 were in use; and in 1902 there were 19,560. Again, penny-in-the-slot meters had gained ground greatly; their convenience being so apparent, especially to small householders. In 1892 they had 20 of these in use; but in 1902 the number had increased to 6955. The Company had got rid of the responsibility of lighting the public lamps, this work being undertaken by the city authorities. The present storage capacity of the holders was 15,000,000 cubic feet, against 1,700,000 feet in 1862; and their mains in miles now stood at 338, against 108 in 1862. The number of public lamps in 1852 was 3004; to-day it was 8943. These facts and figures, he thought, could not fail to interest the public and the shareholders. He heartily congratulated the latter on the progress of the Company, and on the stable position it occupied. If, beyond the statistics he had given, further testimony was required, they had it in a letter which had been received from Mr. Corbet Woodall, who was recognized as the leading authority upon gas concerns in the country. That gentleman had recently written to their Secretary a letter, in which he remarked upon the consistent progress of the Company, and expressed the opinion that it was practically unequalled in the country, having regard to all the circumstances.

Mr. ROBJENT seconded the motion, and it was carried unanimously. The dividend recommended was then declared.

BROMLEY GAS CONSUMERS' COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Thursday at the Bell Hotel, Bromley—Mr. ALEXANDER DICKSON in the chair.

The SECRETARY (Mr. H. W. Amos) read the notice calling the meeting; and it was then agreed to take as read the Directors' report and the accounts.

The CHAIRMAN, in moving their adoption, said there were some people who seemed disposed to regard references to the weather by gas companies as accounting for diminished returns, very much in the same light as they would the apologetic explanations of chronic dyspeptics; but a little consideration of the larger use of gas in recent years for heating, must, he thought, gain their recognition of the fact that, when but two or three waves of cold air, prevalent for only a few days, passed over the country in the winter, gas-fires were seldom lighted, and when strong cyclonic conditions were maintained in rapid succession, as had been the case for months past, preventing the gathering of smoke clouds and fog, artificial light was kept very much at its minimum. And conversely, when in the summer and early autumn (like those of last year) colder or duller conditions prevailed, the consumption of gas increased. But the retarding influence of a mild winter was proportionately very much greater than the advantage from a colder summer. Thus the half year, which commenced for the Company (in the first four months) with a most promising growth, closed with but a nominal addition to the consumption of the last half of the previous year—that was to say, 2¼ million cubic feet. This retarding influence had remained operative during the four principal months of the past winter, until the appearance of a little snow within the last two or three days had been positively refreshing. Nevertheless, it was very much better to have a small increase than none at all; and as the number of the consumers was still enlarging, they might hope for better results to follow. As a means of encouraging business, the Directors had decided to reduce the price of gas by 1d. per 1000 cubic feet as from Lady-day next. Coals were yet firm, at nearly 50 per cent. more than when the Company were previously supplying gas at 3s. per 1000 cubic feet. But having recouped their sacrifices under the coal boom, the Directors were anxious to restore the old price, to enlarge their market. He had seen no attempt made to controvert the statement published some time ago of the great reduction in the output of coal by the miners per man in recent years; and the answer of the Chancellor of the Exchequer to the deputation of miners who waited upon him a few days since, and who were so very anxious for the withdrawal of the 1s. per ton export tax, was good news for gas suppliers, when they recollected the extent of the advance obtained in the price of coal through foreign purchases in the spring of 1900, from which the gas industry had not yet recovered. It would be time to consider its abolition when the former prices were restored. In the report, the Directors reminded the proprietors that: "While some of the larger gas companies found it necessary to increase their price for gas by 6d. or 7d per 1000 cubic feet, when the cost of coal advanced to the top prices of three years ago, this Company only charged an extra 4d. per 1000 cubic feet. Of this, one-half was remitted at Michaelmas, 1901, and another 1d. at Midsummer last. The cost of coal still remains nearly 50 per cent. higher than it stood when the Company's price of gas was formerly charged at 3s. per 1000 cubic feet; but the Directors have decided to reduce the price of gas from 3s. 1d. to 3s. as from and after the reading of the meter indices at Lady-day." He thought this paragraph would have been read with keen interest by the proprietors; and he hoped it would be received with gratification by the consumers. With the statement that the new town offices were quite answering their intended purpose, and were a great convenience to the consumers, the Chairman passed to the accounts. Taking them in comparison with the corresponding period of the preceding year, the various rises and falls both in receipts and expenditure were noted by the Chairman; but most of them were of small amount, and only two or three need be mentioned here. He said that the revenue had in the total increased by £170. The gas-rental was £132 less. This was by reason of the reduced price they had been charging—viz., 3s. 1d. during the whole of the half year, as against 3s. 4d. in one quarter and 3s. 2d. in another quarter of the corresponding period of 1901. Coals had saved them £1044; and altogether the decreased items of expenditure represented about £1320. The increased items on the expenditure side of the account amounted to about £896; among them being carbonizing wages £315, and £123 for increased rates—not increased assessments. The net decrease in expenditure was £424; and thus the net advantage from both sides of the account was £594. In the profit and loss account, the interest on the debenture stock was slightly increased by the sale of the £750 remaining to be issued of the original loan capital, and the interest paid on loans from the bankers pending the sale of the debenture stock in January last was also a little more—about £83 between the two. The general result was they had profits sufficient to make payment of dividends at equivalent rates to those previously declared, and to leave a balance to be carried forward to the next account—increased, by some £540, to £3518. He thought this was a very satisfactory issue from a period of two years of more than ordinary anxiety. The conversion of the shares into stock, effected by the Act on Jan. 1, had been duly registered in the new stock registers; and the stock certificates had been delivered. The dividends now to be paid would be declared at the respective rates set out in the next resolution; and it would be a pleasure, he was sure, to the Secretary to convince any doubting proprietor that his income on the new stock was exactly equivalent, save for any variations of past income-tax, to what he previously had on the shares represented by that stock. There was only one other item to which he would make passing allusion, though it really referred to the accounts for the current half year. The Directors in January offered for sale by tender 3½ per cent. debenture stock to the amount of £7000, and received tenders in excess of the stock. The whole of the disposable amount was placed at prices between £95 and £96 per cent., so that this capital would cost the Company about £3 12s. per cent.

The DEPUTY-CHAIRMAN (Mr. B. H. Latter) seconded the motion.

The CHAIRMAN gave a further explanation to an inquiring proprietor regarding the cost of coal; and, at the end of his remarks, he stated that, while the Company had been working under an agreement with the Chatham and Dover Railway Company, ever since the great widening was made, for the transit of their coal over the Company's siding at a certain maximum charge, they had within the last part of the half year been fortunate enough to obtain a reduction of 2d. per ton on the future carriage of the coal to the works.

The motion was unanimously carried.

On the proposition of the CHAIRMAN, seconded by the DEPUTY-CHAIRMAN, dividends were declared at the rates of 6 per cent. per annum on the 5 per cent. "A" ordinary stock, and of 4½ per cent. on the 3½ per cent. "B" ordinary stock, both less income-tax.

The retiring Directors (Messrs. A. E. Willett and A. S. Gedge) and Auditor (Mr. A. S. Hicks) were unanimously re-elected.

The CHAIRMAN said the special matters referred to in the report had next to be considered. The first was as to the qualification of the Directors. Under the old conditions, the qualification of a Director of the Company was possession in his own right of twenty shares. The shares had ceased to be; and the holding was now in stock. It was therefore desirable that a resolution should be passed with respect to the qualification. The Board were of opinion that the circumstances of to-day and the growth of the Company warranted the fixing of the qualifying holding at the sum of £500. This was not greatly larger than the old holding, which would represent £400 of stock; but the £500 was rather more appropriate to present circumstances. The resolution was: "That the qualification of a Director of the Company shall, from and after this date, be the possession in his own right of £500 of 'A' ordinary stock or of 'B' ordinary stock, or of a like aggregate amount of such stocks, at the least in the undertaking."

The DEPUTY-CHAIRMAN seconded the motion, which was agreed to.

The Auditors' holding qualification was afterwards fixed at £20 of stock—the Chairman remarking that there was no amount specified in the Company's Special Act; but in the Companies' Clauses Consolidation Act the possession of one share was prescribed, and this would be represented by £20 of stock.

The CHAIRMAN said another subject for consideration was the remuneration of the Directors and of the Auditors. It would be in the recollection of the proprietors who attended the last general meeting that a proprietor suggested that a sufficiently long interval had elapsed between the last revision of the Board's remuneration for an alteration to be now made. The Directors had since considered the matter, and, of course, it was fully within their privity; and their view was that, having regard to the increased responsibilities and labour devolving upon them, the proposition which was to be submitted had their full concurrence.

On the motion of Mr. ROLANDI, a resolution was passed, fixing the Directors' remuneration as from Christmas last at £1000 per annum, divisible as they might determine.

The CHAIRMAN having expressed, on behalf of himself and his colleagues, their sincere appreciation of this recognition of the work they did.

A further resolution was passed fixing the remuneration of the Auditors at the rate of 30 guineas each per annum.

A vote of thanks was also accorded to the Chairman and Directors, and recognition was afterwards made of the careful and valuable services of the Engineer (Mr. W. Woodward), the Secretary, and their respective staffs.

ASCOT DISTRICT GAS COMPANY.

The Ordinary Half-Yearly Meeting of this Company was held on Monday last week, at the London Offices, No. 50, Cannon Street—Mr. JOSEPH MANWARING in the chair.

The SECRETARY (Mr. W. A. Schultz, F.C.A.) read the notice convening the meeting; and before proceeding to the ordinary business, a resolution was passed recording the deep regret of the shareholders at the death of the late Chairman, Mr. Robert Berridge, and their sincere sympathy with his wife and family.

The CHAIRMAN, in moving the adoption of the report and accounts, said that in a sense he was sorry to be occupying the chair that day. Their old and esteemed friend Mr. Berridge had been faithful to the interests of the Company ever since its formation in 1882; and it was only natural that, after an association of over twenty years, they should feel his loss very keenly. The balance-sheet was once more very satisfactory. The working for the half year just ended had shown a very decided step in the right direction. There was an increase of upwards of 2 million cubic feet (or about 13 per cent.) in the quantity of gas manufactured; while the sales had gone up 12 per cent. The amount of unaccounted-for gas was very satisfactorily low, being now only 5 per cent. of the output. The quantity of gas yielded per ton was rather below the previous year's figures; but taking into consideration the fact that in the six months under review they had been using partly Durham coal (at, of course, a lower price), whereas in 1901 they employed Silkstone, the returns showed up exceedingly well—the make being 10,839 cubic feet per ton, as against 11,076 feet. The quantity sold per ton—10,098 cubic feet against 10,254 feet—was also lower; but it must still be regarded as remarkably good. Residuals showed up very well, there being an increase of over £108 in the revenue from this source. The number of consumers was still growing; and the Directors had decided that the time had arrived when a reduction could safely be made in the price of gas. It had therefore been resolved that the price should be reduced from 4s. 9d. for ordinary consumers and 4s. 6d. where gas-stoves were used to 4s. 6d. and 4s. 3d. respectively. The number of ordinary consumers was 567, against 510 at Dec. 31, 1901; prepayment consumers, 231, against 210; stoves on hire, 364, against 319. The number of public lamps remained the same—129. It was interesting to notice the progress made by the Company in recent years. Comparing the figures for the past half year with those of 1898—only four years ago—the sales of gas had increased by nearly 80 per cent., the sale of coke had more than doubled itself, the total revenue from residuals had increased by about 116 per cent., and the total profit had just about doubled. These facts spoke for themselves. Owing to the vacancy caused by the death of Mr. Berridge, the Directors considered that the Board would be strengthened by the addition of Mr. Bridges, who had for many years been Auditor to the Company. He had been a shareholder from the beginning; and the Directors thought they could not do better than ask him to join the Board.

The motion having been seconded and carried,

Mr. S. SPENCER, referring to the appointment of Mr. Bridges, said that he himself had also for some time been a candidate for the next vacancy on the Board; and he thought therefore that the Directors should have taken the wishes of the shareholders on the matter. Under these circumstances, he should, when next Mr. Bridges came up for re-election, fight him for the seat. He also pointed out that the Board had no power to appoint Dr. Strong an Auditor in place of Mr. Bridges. They could only elect him provisionally, and then he should have signed the accounts as Auditor *pro tem.* It was for the shareholders to fill the position.

Mr. HENRY WOODALL, in moving the declaration of a dividend at the rate of 5 per cent. per annum, remarked that when things were at the very best possible, any alteration must be for the worse; and there were so many features in the present accounts that were the best possible, that he should not be surprised if in the future they witnessed some slight diminution here and there. It would, however, be the endeavour of the Board and the officials to keep pace with the good things of the present day. To show what good things were being done, he might point out that the sale of coke last half year ran to 10¼ cwt. per ton of coal. This result was obtained with ordinary furnaces slightly improved by their Manager; and it caused one to reflect whether "up-to-datism" pays, seeing that their results were superior to those produced by more modern apparatus. He could name many places where almost double the money had been spent on the retort-house, but where the working was inferior to theirs. Considering that their sale of gas was only 1 million cubic feet per annum to each mile of main, the figure at which the leakage now stood reflected the greatest credit on the management. Probably a portion of the reduction of this item was due to the acquisition of the custom of the Railway Company, who took the gas but distributed it themselves. They allowed the Railway Company a reduction of price to 3s. 6d. per 1000 cubic feet—taking into account the fact that they suffered a loss in leakage through undertaking their own distribution.

The payment of the dividend having been agreed to, the retiring Director (Mr. Alfred Kitt) and Auditors (Mr. T. A. Welton and Dr. H. J. Strong, J.P.) were reappointed, and it was resolved that the salary of the Secretary, including clerical assistance, should be increased, as from January 1 last, to £300 per annum. In moving the last resolution, the Chairman referred in appreciative terms to the great services rendered by Mr. Schultz to the Company, as well as to the fact that up till now his salary had been inadequate for the work he had to perform.

The SECRETARY thanked the shareholders for their kindness in unanimously voting him the increase of remuneration; and the proceedings concluded with the usual votes of thanks.

BARNET DISTRICT GAS AND WATER COMPANY.

The Half-Yearly Meeting of this Company was held last Friday, at the Albion Tavern, Aldersgate Street—Mr. CHARLES HORSLEY, J.P., in the chair.

The SECRETARY (Mr. Ernest W. Drew, F.C.A.) read the notice convening the meeting; and the report and accounts were then taken as read.

The CHAIRMAN, in moving their adoption, first paraphrazed the items of the report. He said the London Water Bill had received the Royal Assent; and the Directors were glad to report that the proposed amendments prejudicial to the interests of the Company were not adopted. They were therefore "as they were." To gain this end, it had cost more than £800; but the result was well worth the money. The price of gas had been reduced from 4s. to 3s. 10d. per 1000 cubic feet as from Jan. 1; and so the public were getting the benefit of the lower price of coal. During the half year, the report stated, there had been a "fairly" satisfactory increase in both the gas and water revenue; but he regarded it as a very good one indeed. The duplicate engines and pumping machinery at East Barnet had now been completed, and were in working order; and the supply of water from the well continued very satisfactory. Now that the engines were in this position, he hoped they would be able to drive adits in the district, and improve the supply. It was with much regret that he had to inform the shareholders that their old friend and Chairman (Mr. James Glaisher, F.R.S.) died a short time ago. A letter of sympathy was sent by the Board to his son (Dr. Glaisher), and of this action he was sure the shareholders would all approve. He had known Mr. Glaisher long and intimately; and he had always found him a faithful friend. He (the Chairman) wished to publicly make reference to the Colney Hatch Fire, which they all deeply regretted. Some of the papers had said there was a shortness of water from the Barnet Company. He wished it to be understood that the Company were not in any way responsible. The water supplied by them during the repair of the machinery at the asylum was constantly laid on under good pressure to meters at the asylum; and the authorities there could at any time—night or day—obtain the water they required. He believed the asylum storage was filled up every night; and this was explained at the inquest by both the Solicitor and the Engineer. The shareholders would be pleased to know the Company were not on this occasion short of water; and it was quite a mistake on the part of the papers to say that they were. The meter was on the asylum premises; and they had nothing to do but to turn the water on. A 9-inch main ran right past the asylum; and the Company had large quantities of

reservoir power. In his opinion, it would not have mattered how much water they had on that fatal morning; for nothing would have put out the fire when once it had got a hold of the buildings. Turning to the accounts, he said the profit for the half year amounted to £12,919; and after deducting interest on mortgage bonds, &c., there remained a net profit of £10,893. Out of this, the Directors were proposing to pay ½ per cent. more dividend on this occasion; and he hoped that at the next annual meeting they would be able to give the shareholders a further ½ per cent. When, in adverse circumstances, the Directors had to reduce the dividend, the shareholders accepted it freely, and frankly believed what was told them. Now the Board were bringing the dividend back to what it was before; and he was very pleased that they were in a position to do so. They were also making up the reserve to what might be called a satisfactory figure. Regarding the working of the gas undertaking, he might mention that the gas made per ton of coal carbonized was 10,961 cubic feet; and this was very good. The unaccounted-for gas was 6·51 per cent. on the make. The increase in the gas sold was about 5 per cent. The quantity of gas sold was 47,937,350 cubic feet, and sold per ton of coal carbonized 10,084 cubic feet. These figures were excellent; and he was always able to give their Engineer (Mr. T. H. Martin) credit for making a good amount of gas from his coal. There had been an increase in the profits on gas of £1230, and on water of £1376.

The Deputy-Chairman (Mr. A. H. Baynes) seconded the motion, which was unanimously adopted.

On the proposition of the Chairman, seconded by Dr. J. W. L. Glaisher, dividends were declared at the rates of 7½ per cent. per annum on the "A" and "C" stocks, 6½ per cent. per annum on the "B" stock, and 5¼ per cent. on the "D" capital gas and water stocks, less income-tax.

The retiring Directors (Mr. Alfred Lass and Mr. A. F. Phillips) were unanimously re-elected. In the course of a few remarks on the re-election of the latter gentleman Mr. F. Smith remarked that Sir George Livesey had recently said that one of the great requisites of joint-stock gas companies at the present time was to have directors thoroughly expert in the business which they had to work. In Mr. Phillips, they had a gentleman who had a life-long experience of both gas and water affairs; and the Company were fortunate in having him as a Director. In his reply, Mr. Phillips also observed that he thought it was an advantage all round for a director to understand the business he had to manage. The work was also easier for the director himself if he had a practical knowledge of the business that came before him.

The retiring Auditor (Mr. C. P. Crookenden) was also re-appointed.

The thanks of the shareholders having been passed to the Engineer and Manager (Mr. T. H. Martin), a similar compliment was paid to the Secretary (Mr. E. W. Drew), the Chief Cashier (Mr. T. Wright), and the official staff.

Mr. Samuel Cutler, in proposing a vote of thanks to the Chairman and Directors, said the shareholders must congratulate themselves upon the expert character of the Directors who presided over the affairs of the Company. Surrounding the table, they had gentlemen intimately acquainted with gas and water matters; and they could not have a body of men better fitted for controlling the business of the Company than they now had. The accounts proved that this was so; and he considered they might congratulate themselves upon the fact. He thought that some reference should be made from the shareholders' side of the table regarding their friend who had passed away (Mr. Glaisher). Most of them had known him for many years; and he (Mr. Cutler), as a shareholder, would like to assure Dr. Glaisher of their great sorrow at the loss of him who had so recently gone to his rest.

Mr. Yeo seconded the motion, and it was heartily agreed to.

A brief response from the Chairman ended the proceedings.

PLYMOUTH AND STONEHOUSE GAS COMPANY.

The New Bill.

A Meeting of Shareholders in the Plymouth and Stonehouse Gas Company was held last Thursday—Mr. J. A. Bellamy, the Chairman, presiding—to consider the Bill which the Company are promoting in the present session.

Mr. J. Shelly, the Company's Solicitor, explained the provisions of the Bill, which include an extension of the limits of supply to the parish of Plymstock, which is adjacent to Plymouth, and the raising of additional capital by an amount not exceeding £100,000. The new stock, like the existing stock, would be offered by auction or tender; and the Bill provided that any new stock not sold should be offered to the employees and consumers. The Company might create and issue debenture stock. There was also provision for the reduction of the illuminating power of the gas to 13 candles.

The Chairman, replying to questions, said the present authorized capital of the Company was £315,000 of ordinary stock, and £90,000 of debentures. Of this capital there was unissued £70,000 of ordinary stock, and £20,000 of debentures. With regard to the additional capital, it had been felt desirable for some time that they should get new purifiers, exhauster, and Livesey washer; and more carbonizing plant had become essential. The cost of the new plant, which would include an installation of inclined retorts and coke-handling machinery, might be put roughly at £40,000. This expenditure would leave them with only £30,000 of unexpended capital; and as they had become buyers of cooking-stoves in very large numbers, absorbing many thousands a year, it was clear that they would not be able to get along without going to Parliament very soon. They thought it better to go at once; but they hoped that the additional capital now asked for would carry them on for a great number of years. With regard to the new carbonizing plant, the Engineer and a few of the Directors had inspected the various systems of inclined retorts in this country, and they also went to Berlin. As the result, they had determined to adopt the Stettin system; and they had entered into a contract with Messrs. Willey and Co., of Exeter, for a complete installation of that system. They were satisfied that the economy effected in the production of gas would be sufficient to more than pay the interest on the entire outlay of £40,000. As to the illuminating power of the gas, Parliament had recognized, in the case of the South Metropolitan and some other Gas Companies, that with the incandescent mantle it did not matter to the consumer whether the gas was of 16 or 14 candle power. The Plymouth Company were asking for a little bit more, because their present power was 15 candles, and they wanted a reduction to 13. There was, however, the question of the calorific value of the gas to be considered, and the Engineer (Mr. Percy Hoyte) was carrying out experiments to ascertain what would be the effect in this direction of a reduction to 13 candles. If they found that by the reduction to 13 candles the heating power was diminished, the Directors proposed to abandon the idea, and ask to have the illuminating power put on the old basis of 14 candles. While they thought that a reduction of the illuminating power would be very desirable, and would help towards the attainment of the ideal of gas at 1s. 6d. per 1000 cubic feet, they must at the same time be careful not to do anything which would cause dissatisfaction to any section of the consumers. In cases where the illuminating power had been lowered by two candles, a reduction had been made in the standard price. In the Bill there was no reference to any alteration in this respect; and it might be that it would be better to keep to 15 candles rather than submit to any lowering of the standard price. With regard to the extension of the area of supply, it would be impossible for the Company to incur the capital outlay to reach the districts beyond the borough and supply gas at the same price as in Plymouth. They therefore asked Parliament to sanction a differential rate of 1s. per 1000 cubic feet for these places. Even at 2s. 9d., gas would be considerably cheaper in these villages than in any similarly situated district in any other part of the country. He thought there would be no opposition to the Bill on the part of the Plymouth Corporation. The Stonehouse District Council were, however, opposing the Company, but had not disclosed their grounds. In reply to a question, the Chairman added that the Directors would not consent to a reduction of one candle in the illuminating power if accompanied by a reduction of 1d. in the standard price.

The resolution authorizing the promotion of the Bill was then passed, as was also one enabling the Directors to make a fresh issue of capital.

PROVINCIAL GAS AND WATER COMPANIES.

GAS.

Increased Business at Portsmouth.

Presiding at the half-yearly general meeting of the Portsea Island Gas Company on the 21st ult., Alderman Sir J. Baker, in moving the adoption of the report, laid stress upon the fact that the business of the Company had been greater in the six months ending the 31st of December than in any previous similar period. It was quite clear, he remarked, that they had not taken in hand the new works at Hilsea any too soon. They were negotiating in 1898 for the land for these works, and in that year their production of gas was a little more than 751 million cubic feet; but the growth since then had amounted to no less than 52 per cent. The penny-in-the-slot consumption had been most marvellous. There was a sum of £39,440 available for distribution; and dividends were declared at the rates of 13, 12, and 10 per cent. per annum on the three classes of shares, and 5 per cent. on the stock; leaving £25,497 to be carried forward.

Preparing for More Business at Waltham Abbey.

According to the report presented at the half-yearly meeting of the Waltham Abbey and Cheshunt Gas Company last Friday, the quantity of gas sold in the six months ending Dec. 31 last was 4·02 per cent. more than it was in the corresponding period of 1901. This was very gratifying indeed. The revenue was £5674, and the expenditure £3811; so that £1863 was carried to the profit and loss account. The amount available for distribution was £2419, and £1829 of it was used in the payment of dividends for the half year at the rates of 8 and 6 per cent. per annum. In their report, the Directors stated that all the manufacturing and distributing plant (under the supervision of Mr. W. Bince Randall, the Engineer and Secretary) was in excellent order, and, generally speaking, was largely in excess of present requirements. Much capital has been expended of late years in anticipation of increasing business; but it will prove highly profitable in the future.

Prepayment Supplies and Reduced Price at Richmond.

At the half-yearly general meeting of the Richmond (Surrey) Gas Company last Thursday, the Chairman (Mr. T. J. Carless) stated that the growth of the automatic system of gas supply had again necessitated the laying of a large number of new services, and in some cases of new mains; and there had also been considerable expenditure during the past half year for new cooking-stoves to meet the demand for gas for culinary purposes. The price had been brought down to 2s. 10d. per 1000 cubic feet as from the December quarter, which was the lowest figure at which the Company had ever supplied it; and he was hopeful that this concession would bring about a considerable increase in consumption to justify the action of the Directors in somewhat anticipating the future. The result of the working in the six months ending Dec. 31 was a net profit of £4755, which was sufficient to pay the statutory dividend and allow of nearly £500 being carried forward.

The Burden of Rates at Salisbury.

At the recent half-yearly meeting of the Salisbury Gas Company, the Chairman (Mr. G. Fullford) told the shareholders that the item of rates and taxes in the accounts was assuming formidable proportions; the Company's contribution alone for the past year being no less than £587, or equivalent to 2d. per 1000 cubic feet of gas sold. Notwithstanding this, however, the Company were able to reduce the price

of gas 2d. per 1000 cubic feet on the 1st of October; and the demand for lighting, heating, and cooking purposes was well maintained during the half year. Mr. Fullford referred with gratification to the fact that the Company were among the first to adopt the system of maintenance of incandescent burners, both for inside and outside lighting, by their own skilled workmen; and it was now generally adopted by gas companies, and had proved a great advantage to the consumers. Dividends at rates ranging from 5 to 10 per cent. per annum on the various classes of shares were declared; and the services of the Board, the Engineer (Mr. Norton H. Humphrys, Assoc.M.Inst.C.E.), and the staff generally, were acknowledged.

Gas for Heating Purposes at Longwood.

At the recent annual meeting of the Longwood Gas Company, Mr. R. Thornton, in seconding the motion for the adoption of the Directors' report, gave some statistics illustrating the progress of the undertaking. He said the consumption during the year had been 79,690,000 cubic feet—an increase of 10 millions upon the preceding year. The number of meters had gone up by 291, and the number of cookers by 112. A new departure had been made in the way of hiring out gas-fires and gas-boilers; and this had been much appreciated by the consumers, inasmuch as 33 of each were fixed at the end of the year. The quantity of gas sold for heating and motive power was 17,191,200 cubic feet, or 21·48 per cent. The sale of gas per ton of coal carbonized had been 400 cubic feet more than in the preceding year, and the leakage had been reduced from 12 to 9 per cent. The works (under the supervision of Mr. J. H. Brearley) had been maintained in a thoroughly satisfactory condition. The total liability to the Colne Vale Company had been discharged; and the capital per 1000 cubic feet of gas sold at the end of the year stood at 19s., against 25s. eight years ago. Seven years ago there were four works supplying gas within the Company's area, and now there was only those of the Company. Dividends were declared at the rate of 7½ per cent. on the original shares, and 5½ per cent. on the new ordinary shares.

Reduction in Price at West Ham.

The report which the Directors of the West Ham Gas Company presented at the half-yearly meeting last Friday stated that the price of gas had, as from the beginning of the present year, been reduced to 2s. 11d. per 1000 cubic feet, which is the standard price fixed by their Act of last session in relation to the standard dividend of 5 per cent. on the consolidated stock. The conversion of shares into stock has been duly effected; and, in accordance with the provisions of the Act, the prepayment meter system has been put in operation. Over 1000 applications for automatic services have already been received; and further capital is to be raised to meet the large outlay involved in fitting up the installations. A carburetted water-gas plant has been erected at the old works, and has just been started. The expenditure on revenue account during the half year amounted to £87,513, and the receipts to £107,945. After payment of interest charges, &c., there was a balance left available for dividend of £18,867. Out of this, the Directors recommended the payment of the statutory dividends of 10 and 7 per cent. per annum on the £5 and £10 shares respectively. This will absorb £17,645, leaving £1222 to be carried forward. The total quantity of gas made was 588,465,000 cubic feet, as compared with 580,337,000 feet in the corresponding half of the previous year; and in its manufacture 55,613 tons of coal and 32,153 gallons of oil were used, as against 55,602 tons of coal and 31,252 gallons of oil in 1901.

Increased Consumption and Good Policy at Eastbourne.

The Chairman of the Eastbourne Gas Company (Dr. G. A. Jeffery), when addressing the shareholders at the half-yearly general meeting on Monday last week, pointed to the accounts presented as furnishing evidence that the undertaking was a progressive one. Though the past half year had not been a "fat" one, it had certainly not been "lean." The Directors were in a position to pay the shareholders the high dividends they had enjoyed for many years; and they were able to do this for the most satisfactory of reasons—they had earned them. Compared with the corresponding period of 1901, the sale of gas had risen from 163,368,000 to 170,545,000 cubic feet—an increase of 6,707,000 cubic feet, or 4 per cent., which was surprising, considering the mild weather. The profit was £8486, against £7117; being an increase of £1369. Coals and gas-manufacturing materials cost £13,926, compared with £15,068; being a decrease of £1142. The net expenditure for coal and oil was £7536—a decrease of £746; while the cost of manufacturing, wages, &c., was £4387, or a gain of £58. The report of the Directors was adopted, and dividends were declared at the rates of 14½ and 11½ per cent. per annum. The payment of these absorbed £6783 of the £19,752 available for distribution; leaving a balance of £12,969 to be carried forward. In the vote of thanks to the Directors and officials, the services of Mr. H. E. Jones, the Company's Consulting Engineer, of Mr. J. Hammond, the Resident Engineer and Manager, and of Mr. J. S. Garrard, the Secretary, were recognized. In acknowledging the compliment to himself, Mr. Jones stated that all through his long connection with the Company the Directors had never pursued a "penny wise and pound foolish" policy, but had spent what money was necessary to maintain the concern at a high state of efficiency.

The Competition of the Electric Light at Aldershot.

In moving the adoption of the Directors' report at the recent half-yearly meeting of the Aldershot Gas and Water Company, the Chairman (Mr. A. F. Wilson) referred to the introduction of the electric light into the town, and stated that certain of the Company's old customers had adopted it, and some of the shops were now lighted by electricity. At the same time he could not help expressing an opinion that they did not show to any great advantage over those which were still lighted by the ordinary means. As a matter of fact, even with the electric light, the Company still showed an increased consumption of upwards of 6 per cent. throughout their district. A very considerable item in the expenditure continued to be the charge for rates; the Company being the largest ratepayers in the town. In the six months ending the 31st of December the amount had increased by about £75. In this connection he pointed out that evidence from the experience of other places went to show that it was highly probable Aldershot might be called upon in process of time to meet a financial deficiency in the Electric Lighting Department. If this should not be the case, the town would be exceptionally fortunate. There was a proposed application to the Local Government Board for increased powers by the Urban District Council, with regard to capital for their electric lighting plant; and with the view of preventing this capital becoming a burden upon the rates, he thought it fair and right that the Council should come under the same obligations and limitations as had been imposed in the cases of the Bermondsey, Stoke Newington, and Woolwich Borough Councils, where the authorities so applying for increased electric lighting powers had been obliged to undertake that the rate charged for electric lighting should in all cases meet the cost. With regard to the affairs of the Company, there was a surplus of £6051 available for distribution; and dividends at the rates of 11½, 8½, and 7 per cent. per annum were declared for the past half year, as well as one at the rate of 6 per cent. per annum on the "A" and "B" shares for the six months ending June 30, 1902. Additional capital being required, the shareholders' sanction was given to the Directors' application to the Board of Trade for a Provisional Order to enable them to raise it.

Improved Plant and Brighter Prospects at South Shields.

There was only a small attendance at the annual meeting of the South Shields Gas Company last Friday, to hear the encouraging statement of the Chairman (Dr. J. F. Armstrong) when moving the adoption of the Directors' report. That document set forth that there had been a marked improvement in the Company's transactions; the revenue account showing a balance of £20,910. The Chairman told the proprietors that the undertaking was in a much better position than it was twelve months ago—not only financially, but in all departments. After four or five "lean" years—years of adversity and anxiety—they had now, he said, turned the corner, and were looking forward to a much brighter and more prosperous future. During the past year, the net revenue amounted to £20,910, which was an increase of £9538 over that of the previous year. After paying the interim dividend and the interest on the bonds, they had an available balance of £10,788. This enabled them to pay the statutory dividend of 3½ per cent., less income-tax, for the half year, which would absorb £6601. This left them with a balance of £4187 to deal with further; and they recommended that £3000 of this should be placed to the credit of the insurance fund. There was still £1187, and some of the Directors thought they might put this to the reserve; but it was decided to carry it forward as a floating balance. The improvement in the manufacture resulting from the introduction of the new plant had been most marked. They had got the inclined retorts to work, and there had been a great saving in many respects; the new plant having economized material and labour very much. They had carbonized 3625 tons less coal; and though there was this reduction, they had sold 2866 tons more coke. They had a yield of 11,016 gallons more tar, and 74 tons more sulphate of ammonia. They had sold 2,123,179 cubic feet more gas than in the preceding year; consequently the receipts from these sources had been very much enhanced. There had been 698 cubic feet more gas sold per ton of coal carbonized, owing to the fact that leakages which previously prevailed all over the town had been remedied. There had been marked economy in the wages—not that they had reduced them, but because the inclined retorts required far fewer hands. The unaccounted-for gas came out last year at 4½ per cent. less than in 1901; the actual saving in this way being 26 million cubic feet, representing in money value something like £3400. There had been an increase of 1077 in the number of consumers, and 3469 slot meters were in use; being an addition of 867, or 33 per cent., for the year. There was still a very large demand for these meters. The report was adopted, and the dividend recommended declared. A pleasing feature of the meeting was the recognition of the great services rendered to the Company by the Secretary (Mr. J. H. Penney) by the addition of £100 per annum to his salary. The work of the Engineer and Manager (Mr. T. H. Duxbury) was also referred to approvingly.

WATER.

The Trouble of the Gosport Water Company.

The agitation which has been going on for several weeks regarding the alleged impurity of the water supplied to the inhabitants of Gosport was the main topic discussed at the half-yearly meeting of the Water Company on Tuesday. The Directors, in their report, stated that analyses of the water had shown a regrettable increase of chlorine and consequent hardness; but that the recent establishment of powerful duplicate pumping machinery at the station had enabled a minute inspection to be made of the well shaft which previously had not been possible. The Company's Engineer, supported by expert geological and analytical opinions, thereupon recommended certain structural works, which were at once taken in hand; and the Directors were advised and believed that these would render the supply in every way satisfactory. The dividends recommended were at the reduced rates of 7½ and 5½ per cent. per annum on the 10 and 7 per cent. stocks, subject to deductions for income-tax. The Chairman (Mr. W. E. Churcher), in moving the adoption of the report, said the agitation which had been going on had to a large extent been unjustifiable, though it was an unfortunate circumstance that the saltness and hardness of the Company's water had increased. The Directors had been accused of neglecting their duty in not investigating the matter before; but they had not been in a position to do so until four months ago, because the pumping power was insufficient to deal with the quantity of water in the well and headings. Since that time, however, it had been ascertained that the water which came in from the eastern heading was considerably charged with saline matter; but it was not pure salt water, as had been asserted by the critics of the Company. Certain works were recommended which would stop off entirely that source of supply; and they had already been placed in the hands of an experienced contractor.

SOUTHPORT CORPORATION GAS SUPPLY.

Proposed New Show-Room for Gas-Stoves.

Last Wednesday, Mr. E. P. Burd, one of the Local Government Board Inspectors, held an inquiry at the Southport Town Hall into an application of the Corporation for a Provisional Order, under section 303 of the Public Health Act, 1875, to alter or amend the Southport Improvement Act, 1871, and Local Acts, so as to enable the Corporation to borrow additional money for the purpose of providing gas stoves, meters, and fittings, or apparatus connected therewith. Among those present were the Chairman of the Gas Committee (Mr. E. Trounson), the Deputy-Mayor, the Gas Manager (Mr. John Booth), the Town Clerk (Mr. J. E. Jarratt), and Mr. R. A. Fletcher, solicitor, who represented the Southport Ironmongers' Association.

The TOWN CLERK stated that under their Provisional Order of 1895 the Corporation were authorized to raise £10,000 for purchasing, hiring, and letting out gas-stoves. By a second Order, obtained in 1899, they were empowered to borrow to the further extent of £5000. The whole of this money had been spent, and the Corporation simply desired a Provisional Order to allow them to raise more.

Mr. *G. Lloyd* (the Borough Accountant) said that of the £15,000 a sum of £6022 had either been paid off or was in the sinking fund; leaving £8978 to be paid off. They had spent £100 since last March.

Mr. FLETCHER submitted that there was already an adequate supply of the articles for which the money was required.

Mr. *Booth* said the Corporation had 2611 cookers on hire, and they desired to take a shop for the exhibition of gas-stoves, &c.; the rental being £225 a year.

Cross-examined: They hoped to increase the sale of the cookers; but the business would not be in any sense more disadvantageous to the ironmongers than it had been. The taking of the shop was consequent upon the Electricity Committee utilizing a portion of the premises used by the Gas Committee. They intended to exhibit the latest designs in stoves, gas-fittings, chandeliers, &c. A suggestion had been made to the local gas fitters and ironmongers to do this; and it had not been taken up by them. But, from his past experience, he believed the Gas Committee could do the business a great deal better than the tradesmen. By the use of gas stoves and cookers, there would be a larger consumption of gas. He could not tell exactly the profit or loss on this part of the business. He did not think that at present there were adequate facilities for inspecting, selecting, and supplying gas-fittings, cookers, &c. The shop would be paid for out of the gas revenue; and he considered it would be beneficial to the ratepayers generally. There were gas consumers in Birkdale who would not have to contribute towards the cost. He was prepared to admit that a large number of gas consumers in Birkdale formed a considerable portion of his customers. He knew the Town Council of Southport had disclaimed any intention of municipal trading. The present proposal was only continuing the policy already carried on.

Mr. FLETCHER pointed out that there was adequate opportunity of inspecting the gas appliances; the ironmongers of Southport having large show-rooms for the purpose, the upkeep for which cost a considerable sum. In spite of the suggestion which had been made, they were prepared to exhibit any special article which the Corporation might desire. Two of the ironmongers had windows in the street in which the shop was situated which were available for the purpose, and it could hardly be deemed necessary that a shop should be taken by the Corporation solely for exhibition purposes, the upkeep of which must cost a considerable permanent annual expenditure. Besides, there were other costly improvements in the town pending.

The TOWN CLERK said the Gas Committee had not tried to mislead the ratepayers in the matter. They did not desire to introduce a new principle, or to do municipal trading, and were, in fact, only carrying out the policy already initiated.

The inquiry then terminated.

PRICE OF GAS AT ROCHDALE.

The question of the price of gas has again been agitating the Committee of the Rochdale Merchants and Tradesmen's Association. At a recent meeting, Mr. Sharp moved that a letter be sent to the Chairman of the Gas Committee of the Corporation, drawing attention to the fact that during the last municipal contest in October he stated that at the end of the financial year his Committee would consider the question of reducing the price of gas. He brought this matter up in accordance with a suggestion made. The charge was considerably too high; and it was their duty, representing as they did a great proportion of people in business in shops, to see that they should not have to pay too much for gas, and thus assist to defray the rates of those who did not burn it. At present, penny-in-the-slot consumers in Rochdale paid 4s. 2d., the ordinary consumers paid 3s. 2d., and the charge for stoves was 2s. 3d. In Bury, the price was only 2s.; and in Manchester, it was 2s. 6d. He considered that the profits made by the Gas Department had for years been too great. In 1900 they were £19,000, in 1901 £12,000, and last year £11,800. But these figures did not take into account the £5000 which the gas consumers alone paid for street lighting. The sum should be shown as profit, so that people might know. In 1900, before the price of gas was advanced, coal cost 11s. 10d. per ton. In 1901, the cost had jumped to 15s. 11d.; and this caused the Committee, of which he was a member, to increase the price. Now coal was bought at 11s. 1d.; and the profits for the year would, in his opinion, be very large, partly because the market prices of some of the residuals had greatly advanced. It was unfair that the consumers should pay the present charge to create a profit for the

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 536.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin 10 p.c.	18½—19½	..	5 7 8
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	Nov. 13	6½	Bombay, Ltd.	5¾—6¼	..	5 4 0
40,000	5	,,	6½	Do. New, £4 paid	4¼—4¾	..	5 9 5
380,000	Stk.	Feb. 26	12	Brentford Consolidated	242—247*	+1	4 17 2
286,700	,,	,,	9	Do. New	177—182*	..	4 18 11
50,000	,,	,,	5	Do. 5 p.c. Pref.	133—135*	..	3 12 6
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	110—113	..	3 10 10
220,000	Stk.	Sept. 11	10½	Brighton & Hove Orig.	212—217	..	4 19 1
246,320	,,	,,	7½	Do. A. Ord. Stk.	155—160	..	4 16 11
460,000	20	Sept. 26	10	British	39½—40½	..	4 18 9
50,000	10	Aug. 14	12	Bromley, Ord. 10 p.c.	—	..	—
82,850	10	,,	9	Do. 7 p.c.	—	..	—
500,000	10	Oct 15	7	Buenos Ayres (New) Ltd	10½—11	..	6 7 3
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	2 —94	..	4 5 1
150,000	20	July 11	8½	Cagliari, Ltd.	23—25	..	6 12 0
100,000	10	Sept. 26	10	Cape Town & Dis., Ltd.	15 —16	..	6 5 0
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	53—55	..	5 9 1
1,375,000	Stk.	Feb. 26	5	Commercial 4 p.c. Stk.	105—108*	+½	4 12 7
503,750	,,	,,	4⅜	Do. 3½ p.c. ,,	99 - 102*	..	4 13 2
407,812	,,	—	3	Do. 3 p.c. Deb.,,	90—9	..	3 4 6
800,000	Stk.	Dec. 11	8	Continental Union, Ltd.	1.5 —125	—5	6 8 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	142—145		4 16 7
575,000	Stk.	Feb. 26	5⅛	Crystal Palace Ord. 5 p.c.	114—119*	..	4 9 6
60,000	,,	,,	5	Do. 5 p.c. Pref.	118—123*	+½	4 1 4
106,158	,,	Jan. 15	5	Do. 5 p.c. Deb. Stk.	137—140	..	3 11 5
486,090	10	Jan. 29	10½	European, Ltd.	18—19	..	5 10 6
354,060	10	,,	10½	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Feb. 12	4 1/16	Gas-light and Coke	4 p.c. Ord.	83—85	.. 5 3 6
2,600,000	,,	,,	3½		3½ p.c. max.	86—88	.. 3 19 7
3,799,735	,,	,,	4		4 p.c. Con. Pref.	106—109	.. 3 13 5
4,193,975	,,	Dec. 11	3		3 p.c. Con. Deb.	91—93	.. 3 4 6
232,500	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.		90—95	.. 5 5 3
70,000	10	Oct 20	8	Hongkong & China, Ltd.		14⅜—15¼	.. 5 3 3
3,800,000	Stk.	Nov. 13	10	Imperial Continental		204—207	.. 4 16 7
473,600	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.		100—103	.. 3 8 0
165,242	Stk.	Aug. 24	6	Lea Bridge Ord. 5 p.c.		115 —120	.. 5 0 0
561,000	Stk.	Feb. 26	10	Liverpool United A		219 —221*	.. 4 10 6
718,100	,,	,,	7	Do. do. B		161—163*	.. 4 5 8
306,083	,,	Dec. 31	4	Do. do. Deb. Stk.		114—116	.. 3 9 0
75,000	5	Dec 11	5	Malta & Medn., Ltd.		4⅜—5	.. 5 0 0
560,000	100	Oct. 1	5	Met. of	5 p.c. Deb.	105—109	.. 4 11 9
250,000	100	,,	4½	Melbourne	4½ p.c. Deb.	103—105	.. 4 5 9
541,920	20	Nov. 13	3½	Monte Video, Ltd.		9½—10¾	.. 6 13 4
1,515,892	Stk.	Feb. 20	4½	Newc'tle & G'tesh d Con.		102⅞—103⅜	.. 4 7 0
346,855	Stk.	Jan. 2	3½	Do. 3½ p.c. Deb.		97—98	.. 3 11 5
300,000	Stk.	Nov. 27	8	Oriental, Ltd.		143—148	.. 5 8 1
600,000	5	Sept. 26	7	Ottoman, Ltd.		6—7	.. 5 0 0

* Ex. div.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
105,005	Stk.	Jan. 15	6⅝	Ply'mth & St'house 5 p.c	127—132	..	4 12 9
851,070	10	Oct. 15	7	River Plate Ord.	10½—11	..	6 7 3
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb..	95—95	..	4 4 3
250,000	10	Sept. 26	8	San Paulo, Ltd..	11¼—12½	..	6 8 0
135,000	Stk.	Sept. 11	10	Sheffield A	238—240	+2	4 3 4
209,984	,,	,,	10	Do. B	238—240	+4	4 3 4
523,498	,,	,,	10	Do. C	238—240	+4	4 3 4
103,235	Stk.	Sept. 26	5	Shrewsbury Ord. 5 p.c.	113—116		4 6 2
6,000,000	Stk.	Feb. 12	5⅛	South Met., 4 p.c. Ord.	120 —122	+1	4 7 4
1,780,000	,,	Jan. 15	3	Do. 3 p.c. Deb.	91—93	.	3 4 6
380,940	Stk.	Nov. 13	5	Southampton Ord.	103—107	..	4 13 6
87,950	,,	Jan. 15	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
120,000	Stk.	Feb. 26	6	Tottenham and Edmonton	A. 5 p.c.	115 —120*	.. 5 0 0
300,520	,,	,,	4½		B. 3½ p.c.	91—94*	.. 4 15 9
182,380	10	Dec 30	5	Tuscan, Ltd..		8½—9½	.. 5 5 3
149,000	10	Jan. 2	5	Do. 5 p.c. Deb. Red.		94—9	.. 5 4 2
730,872	Stk.	—	5†	West Ham, 5 p.c. Ord		97 -102	.. 4 18 0
				WATER COMPANIES.			
780,662	Stk.	Dec. 30	11⅛	Chelsea, Ord.		315—325	.. 3 10 9
150,000	,,	,,	5	Do. 5 p.c. Pref		150—155	.. 3 4 0
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75		138—143	.. 3 2 11
175,785	,,	Sept. 26	4½	Do. 4½ p.c. Deb.		140—145	.. 3 2 1
1,720,560	Stk.	Oct. 15	8	East London, Ord..		223—233	.. 3 8 9
654,740	,,	Dec. 11	4½	Do. 4½ p.c. Deb.		142—147	.. 3 1 3
1,282,943	,,	,,	3	Do. 3 p.c. Deb.		97—99	.. 3 0 7
700,000	50	Dec. 11	8	Grand Junction	10 p.c. max..	117—122	.. 3 5 7
310,000	Stk.	Sept. 26	4		4 p.c. Deb..	125—130	.. 3 1 7
708,000	Stk.	Feb. 26	10½	Kent		295—305*	—5 3 8 10
160,000	,,	,,	7	Do. New, 7 p.c. max..		195—205*	—1½ 3 8 4
1,043,800	100	Dec. 30	11	Lambeth, 10 p.c. max..		305—315	.. 3 9 10
406,200	100	,,	8½	Do. 7½ p.c. max..		220—230	.. 3 13 11
350,000	Stk.	Sept. 26	4	Do. 4 p.c. Deb..		125—130	.. 3 1 7
500,000	100	Feb 12	12 5/16	New River, New Shares		390—400	.. 3 4 0
1,000,000	Stk.	Jan. 29	4	Do. 4 p.c. Deb..		125—130	.. 3 1 7
902,300	Stk.	Dec. 11	7	South-wark and Vauxhall	Ord.	203—208	.. 3 7 4
126 500	100	,,	7		7½ p.c. max.	195—205	—5 3 8 4
489,200	Stk.	,,	5		5 p.c. Pref.	151—154	.. 3 4 11
1,019,585	,,	Oct 15	4		4 p.c. A Deb.	125—130	.. 3 1 7
1,155,066	Stk.	Dec. 11	10	West Middlesex		290—300	.. 3 6 8
200,000	,,	,,	4½	Do. 4½ p.c. Deb.		140—145	.. 3 2 1
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb.		97—99	.. 3 0 7

* Ex. div.

† Next dividend will be at this rate.

benefit of other ratepayers. Mr. Taylor opposed the proposition. He regarded the payment of the present prices as an easy way of reducing the debt of the town. He was speaking as a property owner. Property owners paid the water-rate; but the tenants had to pay for gas. There were five towns in which gas was dearer than in Rochdale; but they were not so heavily rated. Rochdale people boasted of having one of the finest Town Halls in the provinces. How were they going to pay for it? There was no easier way than by doing so out of the gas. Mr. Clark thought the proposition one that they ought to carry. The Association was supposed to work in the interests of the trading community in particular. When they established works as ratepayers, they did not do so with a view to make any great profits, but to get the best for the least money. It was foolishness to make profit out of themselves, and then pay income-tax upon it. Everybody enjoyed the use of the Town Hall, and it was only right that everybody should pay for it—not indirectly, but in rates. Mr. Taylor: We shall have a heavy loss on the electric lighting. How is that to be met? The Chairman (Mr. Fletcher) spoke in favour of the motion, as, in his opinion, the price of gas was too high. They would, he remarked, remember what Alderman Gibson, of Manchester, said to them at the annual dinner recently, in condemnation of relieving the rates from the gas profits. Mr. Taylor pointed out that Alderman Gibson did not carry the Corporation with him. Mr Sharp, in reply, said he did not see why gas consumers should be bound to pay an increased price so that others might have the electric light. Last year the gas profits helped to reduce the general purposes rate to the extent of 1s. 1d. in the pound. The resolution was carried.

ELECTRIC LIGHTING NOTES.

An Unpromising Scheme for Aberavon.

It may be remembered that the Aberavon Town Council, who, some few months since, obtained a Provisional Order from the Local Government Board to enable them to build new gas-works at a cost of £11,300, delayed going on with the scheme pending the delivery of a report of an electrical engineer who had been consulted as to the terms offered the Corporation by the South Wales Power Distribution Company for the supply to them of electricity in bulk for lighting purposes. The Engineer in question (Mr. H. T. Sully, of Bristol) has sent in his report; but the Committee of the Town Council who have considered it are far from being enthusiastic over its contents. Mr. Sully's limit of expense in connection with main laying, rotary converters, accumulator, and transformer chamber is £3880; and he calculates at £495 the income to be derived from 1800 8-candle lamps, and the expenditure on the upkeep of the installation at a similar sum. He does not bring into his estimate any details as to street lighting, but incidentally mentions that arc lamps would cost roughly from £45 to £50 each, and the expense of burning for 2000 hours would be £9 per lamp per annum. In the course of his report, he says: "In accordance with these figures, the whole expense of supplying current will be paid for out of revenue, without coming on the rates." The object of the Town Council is not to lay down an electric lighting installation as a luxury, but, if possible, to make a profit by the sale of current. Mr. Sully, however, will not go so far as this at present; and seeing that he has based the number of electric lamps at 1800, he has reached the length of his tether—indeed, gone beyond it, in the opinion of those who know the town's requirements—in arriving at his probable revenue, for the Aberavon Provisional Order, obtained in 1899, only provides for the laying of mains in two of the principal streets. When the report comes before the Council, it is sure to be severely criticized; and it appears certain that the new gas-works scheme will go forward.

Lively Scenes in the Taunton Town Council.

What has been characterized by a local reporter as "one of the most exciting meetings in the history of the Taunton Town Council" took place a few days ago over a squabble between the Mayor (Mr. J. Standfast) and the Chairman of the Electric Light Committee (Alderman Potter). It began by the former accusing the latter of "deception and misrepresentation in public affairs," and by the latter retorting that the accusation was "a lie." This was a very good beginning; and it was followed by the abrupt termination of the proceedings at the meeting. At a subsequent one, however, these little pleasantries were repeated. Our readers are aware that for some time there has been a good deal of friction and unpleasantness between the Electric Light Committee and certain members of the Council, as well as dissatisfaction among some users of the electric light, owing to their meters not having correctly registered the quantity of current supplied; and matters came to a climax in the criminal proceedings taken against the Electrical Engineer, which, it may be remembered, were dismissed. It appears that at a meeting of the Committee called on the 5th of January to consider the question of supplying a Mr. White, a shirt and collar manufacturer in the town, a resolution was come to that they should offer him power for a 30 horse motor, at an average of eight hours a day, 5½ days a week, for £230 per annum. It was also agreed to supply him with electricity for 100 lamps, on an average of one hour per day, for £70. At 3d. per unit, this would work out at £73 10s. The Mayor remarked: "If you are going to supply electricity for 3d. a unit to one consumer for the first hour, what position will you be in with all the other large consumers in the town?" He said if they looked at the balance-sheet they would find that out of £4000 worth of current £2000 worth was supplied at 6d. per unit; he therefore took exception to the offer. Another Committee meeting was held a few days afterwards, when the former arrangement was altered, as Mr. White said his motor would only average 25-horse power; and it was agreed that this should be supplied at £200 a year. Alderman Potter remarked that they had a strong competitor in gas at Taunton, and that he had seen a letter in which Mr. White had had an offer from the Gas Company to supply 40-horse power at £170 per annum. From the meeting the

FOREMOST FOR 1903

PURIFIERS & VALVES

(PICKERING'S PATENT).

INCLINED RETORTS

(DIDIER SYSTEM).

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Mayor went direct to Mr. Edwards, the Engineer and Secretary of the Company, and asked him if it was the case that he had offered to supply gas equal to 40-horse power for £170; and he replied that no fixed price had been given. This was borne out by a letter he had received from Mr. Edwards, as well as by a statement by Mr. Frank White. Notwithstanding this, the Committee passed a resolution expressing their entire confidence in their Chairman. At the Council meeting, the Mayor said he made the assertion in good faith; and ultimately he withdrew the offensive words he had used. Alderman Potter thought he ought to be allowed to say something on the matter; but he yielded to the wishes of the other members, who said they did not want to hear any more about it—believing probably that the least said the soonest mended. He then withdrew his offensive expression, which he said he had used under great provocation. And so the scene, which had been enlivened by another little squabble, ended.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners have had a busy week. They began on Monday with their usual monthly meeting; then on Wednesday they exposed the Leith Gas-Works for sale; and yesterday they went through the opening ceremony in connection with the Granton works.

To take these events in their turn, at the meeting it was reported by the Engineer (Mr. W. R. Herring) that the make of gas during January, at the Edinburgh and Granton works, was 251 million cubic feet, which was 9821 cubic feet less than in the corresponding month of 1902. The proportion was 75 million cubic feet in Edinburgh, and 185 millions at Granton, which was about a complete reversal of the figures for January of last year, when 180 million cubic feet were made in Edinburgh, and 79 millions in Leith. Since May 16 last, the total make of gas has been 23,972,000 cubic feet less than it was in the corresponding period of 1901-2. No explanation has yet been offered of the decrease; but I believe it is largely due to the fact that since the Granton works began to be operated, it has been impossible to get through the mains the quantity of gas which consumers desired. At this meeting, contracts were entered into for the laying of new mains in the West-end of Edinburgh; so that the Commissioners are fully aware there is something required in the distributing system. An item in the report is worthy of notice. It is that whereas the cost of wages in the carbonizing department per 1000 cubic feet of gas made is given as 4·69d. in the Edinburgh works, at Granton the figure is 1·96d. This may be only the first indication of the economies to be effected at Granton; but, whether it is to be followed up by others or not, it is very encouraging to those who have promoted the scheme of the new works.

To come to the second item in the week's business, the Leith works were exposed for sale by public auction in the rooms of Mr. Dowell, in George Street, Edinburgh, on Wednesday afternoon. The Clerk to the Commissioners (Mr. J. M'G. Jack) was in attendance ready to record a sale; but there was no offerer at the upset price of £26,000, and the sale was adjourned. Apparently the onerous conditions frightened intending purchasers. These included the stipulation that the purchaser was to relieve the Gas Commissioners of an obligation to form a roadway, and was to undertake to pay half the wages of a watchman at a level crossing on the railway. Then there was a further condition, which was not mentioned, but which may have had something to do with the withholding of offers. When the Leith Gas-Works were put down, they had direct access to the sea; but the North British Railway Company made a line for both passengers and goods between them and the water. In respect of this deprivation of right of access, the Company undertook to take away, free of charge, all the refuse from the gas-works. This obligation has been fulfilled till now; but there is a doubt whether it will transmit to another. Apart from the question in law, there is the further consideration that the Leith Dock Commissioners have constructed a dock between the railway and the sea, thereby making the primary reason for the obligation of the Company non-applicable, to say the least of it. The fact is that any purchaser of the gas-works would probably have at once a dispute with the Railway Company as to this matter; and that is another reason why there is no demand for the site. The Gas Commissioners will require to clear the air somewhat before they can hope to get a liberal offer.

To say of the opening of the Granton Gas-Works that it was the great event of the week for the Gas Commissioners, would be only telling a moiety of the truth. Their opening is far more; it is an event in the history of gas supply which has had few equals, and which is not likely to have many in the future. Mr. Herring described them as "brand-new" gas-works. They are this, in every sense of the word; there is not an old piece of machinery in them. But newness in that view is a sense that vanishes when account is taken of the nature of the plant. It is the most approved that can be had; and this not only in bulk but in detail. The principles underlying the different processes are the most modern; and the plant employed in applying them has been selected with the greatest skill—the very best being picked up in every department. Now that they have all been pieced together and set to work, the result is perfection in working; and it could only have been achieved in the hands of one who is a master of his business. The first impression on entering the works is their magnificence, for no other word would be an adequate description. On the occasion of previous visits, there was so much chaos, and so much contractors' material lying about, that it was difficult to foresee the perfect order and simplicity of to-day. Having discussed the prepossessing appearance of the works, it is with all the more satisfaction that the visitor learns that, in addition to this secondary consideration, the works are proving, in operation, to be all that was expected of them. Particularly must this be said of the hydraulic appliance—Mr. Herring's

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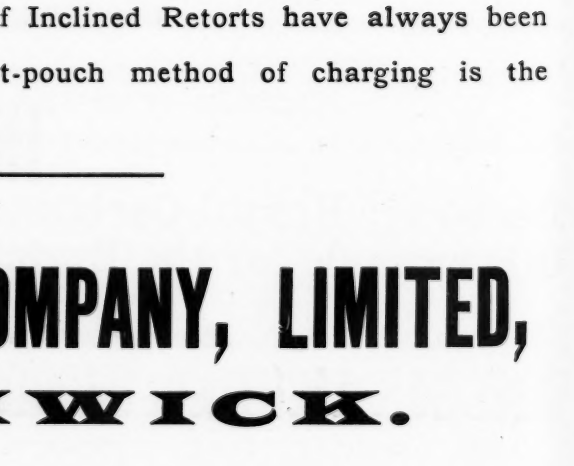

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own invention—for closing the coal-measuring chambers. This appliance, first brought into use here, is found to work unfailingly; and its effect is to lighten the labour of the retort men till it is little more than child's play. There is no need to say more about the plant, as the results already obtained from the works show that everything is running smoothly.

It was a misfortune that the opening day was so boisterous. A special railway train was run from Edinburgh into the works, and, on alighting upon the wind-swept platform, the first consideration was that of personal safety. The state of the weather was the occasion of the curtailment of the part of the proceedings which was really the opening ceremony; and it interfered with the comfort of the whole day. Even in the meter-house, the noise of the wind sometimes drowned the voices of the speakers; while the waiters had to do constant battle, by means of heavy tables, with the irresistible rushes which would not allow the door to remain closed. The meter-house is situated beside the gasholder, and if there was a trace of pleasure to be derived from the prevailing elemental fury, it was to be found in the roar which it made among the lattice-work of the framing, the grandeur of which, somehow, gave the reassuring feeling that, powerful though the wind might be, it had more than met its match. As a matter of fact, the holder was as little moved by the weather as was the solid ground. It was being emptied at the time; and, so far as could be seen, the downward movement of the bell was not affected in any degree by the wind pressure.

The ceremony of Friday marks the completion of a great work, in one sense, though in another it is but the beginning of service. Like a ship leaving port, the gathering was, as it were, the throwing off of the last hawser; and the vessel goes forth to brave the vicissitudes of the voyage. The Granton Gas-Works are now embarked on their voyage of usefulness. The singing of "Auld Lang Syne" on Friday afternoon was the parting cheer to the crew from those on shore. It marked the close of one chapter in the history of gas supply in the capital of Scotland, and the opening of another, the end of which may possibly be found in remote ages, and which every well-wisher will hope may be as auspicious as has been its commencement.

There has been another opening ceremony this week, of a much less imposing and more partial nature, in connection with gas-works. On Wednesday, the additions to the works of the Coupar Angus Gas Company were inaugurated. The Directors invited a company of ladies and gentlemen to take part in the proceedings; and they assembled in the retort-house. Mr. James Brodie, the Chairman of Directors, gave an interesting account of the history of the works. He said the first Company was formed by 45 of the leading citizens as far back as 1836, with a capital of £2000, afterwards increased to £3000, at which sum it remained until last year, when debenture stock was issued to the amount of £1200 to complete the new works. It was not until 1838 that the Company were in a position to uplift pay for the gas—just about 64 years ago. Of the 45 gentlemen who attended the first meeting, not one remained. Mr. Brodie said he had known many of them personally; but all had passed away, and the old works were about to become a thing of the past. In the regulations then in force, a single jet was equal to three moulded candles, and the flame was not to exceed 3 inches, under the penalty of the supply being cut off. Special terms were given to the hand-loom weavers, and each weaver had a single jet for each loom from October to April for 10s. The hours of lighting were from 6 a.m. till daylight, and from sunset till 10 p.m.; so one could see those were not the days of the eight-hour movement. The records stated that "if used on Sunday, one-sixth extra would be charged." Taking the price of gas by decades, it was: 1837, 14s.; 1847, 12s.; 1857, 10s.; 1867, 8s. 4d.; 1877, 7s. 6d.; and at present, 5s. 10d. For some years the Directors had been distressed at the large annual outlay which had been necessary to keep up the works, and they felt that something had to be done involving a large expenditure. A specialist had to be called in as a last resort, and the Directors consulted Mr. W. B. M'Lusky, Manager of the Perth Gas-Works; and now they were there to open the new works, which, he was told, were second to none in any small town in Scotland. The Directors had placed the fullest confidence in Mr. M'Lusky; and he was sure it had not been msiplaced. To him and the late Manager, Mr. Brodie, and to his successor, Mr. Vernon, great credit was due for the interest and energy displayed by them. Mrs. Brodie, wife of the Chairman, then turned on the gas. A retort was charged by Mr. W. F. Vernon, the Manager. The cost of the new buildings and plant has been £1400.

Messrs. Crouch and Hogg, of Glasgow, who have been employed by the Corporation of Arbroath to advise them as to the water supply to the town, have reported unfavourably upon a proposal to take water from the Tarry Burn. In their opinion, the source of that supply is too low to serve the town; and they also point out that the quantity of water to be obtained would most probably be small. The Water Committee have instructed the Engineers to have the water in the burn, as well as that in the Noran stream, gauged during the summer, with a view to determining the capacities of each source.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Feb.* 28.

Sulphate of Ammonia.

Prices have again been irregular, especially at Liverpool, owing to continued reselling, for, while up to £12 12s. 6d. per ton has been realized by makers, there have been second-hand sellers at £12 8s. 9d. The closing quotations are £12 10s. per ton f.o.b. Hull, £12 10s. to £12 12s. 6d. per ton f.o.b. Liverpool, and £12 15s. per ton f.o.b. Leith. There has been a fair amount of inquiry in the forward position, but the firmness of makers has practically precluded business. For April-September, makers require £12 10s. per ton f.o.b. Leith, ordinary

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Among the Companies and Towns supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Southport, Alloa, Broughty Ferry, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Seven Years.

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terms, and £12 15s. per ton for delivery over near months. London, Beckton terms, is likewise quoted £12 15s. per ton, for March-April delivery.

Nitrate of Soda.

This article is steady at 9s. 1½d. to 9s. 3d. per cwt., according to quality.

LONDON, *Feb.* 28.

Tar Products.

The markets are decidedly quiet, and there is nothing of importance to advise. Pitch is easier, especially for forward delivery; manufacturers being evidently anxious to sell while prices remain good. As regards prompt, the demand for export is not so strong, consumers limiting their purchases to their immediate requirements. Benzol continues very dull. Business is reported in 50-90 per cent. at 8¼d. for March-June. In 90 per cent., there is nothing to advise; makers holding for 10d., while buyers will not pay more than from 9¼d. to 9½d. for prompt. In toluol, there is nothing fresh to advise. There is now rather more offering for early delivery; but the recent inquiry appears to have fallen off—at any rate, for the time being. In anthracene, the position remains unchanged, and prices are stationary. Manufacturers will not sell forward, as in many instances they have entirely abandoned the production of the article. Solvent remains without interest; the demand being very limited. In crude carbolic, a large business has been done in 60's at 1s. 6d. for March-April, at which price there are still buyers. Makers as a rule ask 1s. 7d. for April-June; but consumers are not at present prepared to concede any advance for forward delivery. Crystals are steady; but the demand is very limited. In creosote, a very good business has been done during the past week for export from London; but in the North, prices remain easy. One or two contracts have been placed with consumers for early delivery. In tar, contracts have recently been arranged on such extraordinary terms as to render it practically impossible to fix the value; and it seems certain that the result must be a severe loss for the tar distillers who have been rash enough to contract on such terms.

The average values during the week were: Pitch, London, 58s. to 60s.; east coast, 56s. to 57s.; west coast, 54s. 6d. to 55s. Benzol, 90 per cent., 9¼d. to 9⅜d.; 50-90 per cent., 8d. to 8¼d. Toluol, 7d. to 7¼d. Crude naphtha, 3d. to 3¼d.; solvent naphtha, 8¾d. to 9¼d.; heavy naphtha, 9d. to 10d. Creosote, London, 1⅛d. to 1⅜d.; North, 1¼d. to 1⅜d. Heavy oils, 2d. to 2⅛d. Carbolic acid, 60 per cent., 1s. 6d. Naphthalene, 35s. to 55s.; salts, 25s. to 27s. 6d. Anthracene, "A" quality, 1½d. to 1¾d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market continues firm, and prices remain unchanged. The Gaslight and Coke Company ask £12 15s. for March; but they have very little to dispose of. For forward delivery, they quote £12 10s. in any position. Another London Gas Company report having done business at £12 12s. 6d. for March, at which price they are still sellers, but only of a limited quantity. In Hull, a fair business has been done at from £12 8s. 9d. to £12 10s. for prompt; but makers are not offering forward at present. In Leith, the prices remain unchanged; but there is little or no business to advise. In Liverpool, prices are decidedly easier, and business is reported at from £12 8s. 9d. to £12 10s., but only to a limited extent.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The tendency in the coal trade of this district continues in the direction of a slackening demand and lessening firmness in prices All descriptions of round coal are plentiful on the market, owing chiefly to the exceptionally curtailed requirements for house-fire purposes; and this is compelling a resort to still shorter time. Pits raising the better qualities of round coal are in some instances barely working more than 3 days per week, and the maximum average is not more than 4 to 5 days. Considerable quantities of round coal are being forced upon the market here from outside districts at temporarily low-cut prices to effect clearance sales; and Lancashire collieries are finding it increasingly difficult to hold on to their list basis rates. Here and there prices have eased down somewhat rather than allow outside competition to secure local trade; but so far there is no actual quoted reduction on the current basis rates. Some giving way in prices has, however, been under consideration; but colliery owners mostly favour a resort to short time rather than lower prices—the question being whether other districts would co-operate in restricting the output rather than force sales at reduced rates. The average prices just now ruling are ranging from 14s. and 14s. 6d. per ton for the better qualities up to 15s. 6d. for the best descriptions of Wigan Arley, 12s. to 12s. 6d. and 13s. for the commoner sorts of Arley and Pemberton four-feet, and about 10s. to 11s. for common house-fire coals. The larger quantity of the lower qualities of round coal just now being thrown on the market by the limited inquiry for common house-fire purposes is weakening the position with regard to steam and forge coals. Ordinary qualities of steam and forge coal are to be bought at from 8s. to 8s. 3d. per ton at the pit, with better qualities ranging from 8s. 9d. to 9s. 3d. The present restricted production of slack, owing to the depressed condition of the round coal trade, is necessarily limiting the supplies of engine fuel coming on the market, and some of the better sorts are rather scarce, if anything; but the medium and lower qualities are fairly plentiful to meet requirements. Prices are generally maintained at late rates, best slack averaging 6s. 6d. to 7s., medium 5s. 6d. to 5s. 9d., with the commoner sorts obtainable from about 4s. 3d. to 4s. 6d. The shipping trade remains in a very unsatisfactory position; and, with excessive supplies of steam coal offering, extremely low prices have to be taken to secure prompt cargoes—9s. 3d. to 9s. 6d. being quoted in some instances, with better qualities not averaging more than 10s. to 10s. 6d. delivered at the ports on the Mersey.

Gas Cooker Season 1903.

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Northern Coal Trade.

There is considerable irregularity this week in the coal trade, the strong winds having delayed collier-steamers, and thus interfered with the shipments; so that in some cases lower prices have been quoted to keep collieries fully at work. Best Northumbrian steam coals are from 10s. 6d. to 10s. 9d. per ton f.o.b., second-class steams are 9s. 3d. to 9s. 6d., and steam smalls are 5s. 6d. to 5s. 9d. There is still a little export of coal to the United States, chiefly in the form of unscreened steams; and this helps the trade at a time when other exports are limited. Gas coal supplies are plentiful, and prices are weaker; best Durhams being from 9s. to 9s. 3d. per ton for occasional cargoes. It is believed that one of the Dutch contracts for gas coals has been allotted to German coalowners, who are said to have quoted lower prices than British producers. Other contracts are in the market; and it is thought that the competition for some of these will be close. The coal trade, as a whole, however, is being influenced by the position and issue of the Welsh coal crisis. Gas coke is influenced by the lessened demand for export; but there is the steadying effect of a reduction in the output. Prices show no change this week.

Scotch Coal Trade.

There is little change to report in the coal trade in Scotland. Buyers and sellers seem to be both in a waiting mood; but, apart from other considerations, perhaps the boisterous weather which is being experienced is exercising some influence on the market, as shipping is being seriously interfered with. The prices quoted are: Main, 8s. 6d. to 8s. 9d. per ton f.o.b. Glasgow, ell 9s. to 10s., and splint 10s. 6d. to 10s. 9d. The shipments for the week amounted to 176,835 tons—a decrease of 40,052 tons upon the preceding week, but an increase of 2181 tons upon the corresponding week of last year. For the year to date, the total shipments have been 1,326,696 tons—an increase of 60,383 tons upon the same period of last year.

London County Council and Projected Gas Legislation.—At the meeting of the London County Council last Tuesday, it was decided to oppose the Bills promoted by the Crystal Palace District Gas Company and the Gaslight and Coke Company. Mr. J. R. Cousins asked why it was considered necessary to oppose the former Company's Bill, and Mr. John Burns replied that it was to get cheaper gas in South London.

Sale of Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards placed, by order of the Directors, a new issue of South-West Suburban Water Company's 4 per cent. irredeemable debenture stock at prices ranging from £110 to £111 per £100 of stock; and also new issues of ordinary £10 shares (last dividend 5¼ per cent.) and 4 per cent. perpetual debenture stock of the Lowestoft Water and Gas Company—the former at £11 5s., £11 12s. 6d., and £11 15s. each, and the latter at £108, £109, and £110 2s. 6d. per cent.

The London Water Board.—Tuesday, the 24th ult., was the last day for the election of representatives on the Board, the constitution of which is now complete. Probably an official list of the members will shortly be issued.

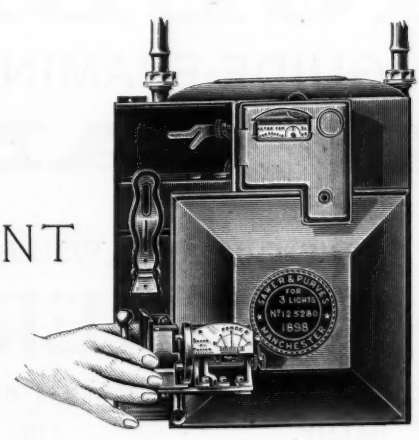
Water Charges at Southport.—At a recent meeting of the Southport, Birkdale, and West Lancashire Joint Water Board, it was resolved that notice should be given to occupiers of all licensed premises and beerhouses, intimating that, from the March quarter-day, water supplied to them shall be charged in accordance with the Board's scale for water supplied by meter, but that in all cases a minimum charge shall be made equal to the amount which would be charged if such premises were supplied for domestic purposes. The decision has been arrived at as the result of inquiries with regard to the charges at Liverpool, Manchester, Blackpool, Bury, Wigan, and Accrington. In no case was the charge for a licensed house less than that for domestic purposes. The change will scarcely affect any of the large hotels, as most of these already consume more water than the minimum quantity which would be charged for if used for domestic purposes.

An Inquiry into London Fogs.—About a year ago the London County Council decided to concur in a suggestion which had been put forward by the Meteorological Council, that it should assist in the initiation of a special inquiry into the conditions associated with the development and distribution of fog in London and its vicinity, and authorized an expenditure of £250 for the purpose, on the condition that all responsibility for the conduct of the investigation should rest with the Meteorological Council. The object of the inquiry was to obtain more definite forecasts or warnings of the approach of fog. A report has now been received by the County Council, from the Secretary of the Meteorological Council, on the results of an inquiry into the matter extending over nearly five months, carried out under the direction of Captain Carpenter, R N. From a summary of the report, it appears that there is no evidence of any special connection between the frequency or intensity of fogs and geological conditions, nor does the locality of the beginning of fog depend upon geological formation. The well-known circumstance that elevated stations are freer from fog than other stations is confirmed. The beginning of a fog seems to be a process depending upon general atmospheric conditions. The actual locality of fog at any particular time seems to depend upon local atmospheric conditions, which require further investigation. There is no evidence tending to show that fogs are formed outside and invade or drift into London. The meteorological conditions for the formation of fog are carefully set out. Captain Carpenter says that a regular system of observations of temperature might indicate the possibility of the local forecasting of fogs, especially if these were made in the early hours of the morning. The Meteorological Council ask the County Council to provide a further £200 to cover the cost of the special reading of thermometers or other instruments; but the General Purposes Committee, in reporting upon the matter, state that they do not see their way to recommend any further expenditure for the purpose.

"EFFICIENCY"—*i.e.*

SAWER & PURVES'

"Positive."



PREPAYMENT METER.

Incandescent Trust, Limited.—In the Chancery Division of the High Court of Justice a few days ago, Mr. Justice Buckley had before him a petition presented by Winifred Mundler for the compulsory winding up of the above-named concern. The petition had been standing over for a long time. Counsel for the petitioner stated that there had been an order for his client's cross-examination on her affidavit, but she had been too ill to attend before the Examiner. She had obtained judgment for money which she alleged to be due to her owing to the default of the Company; but the Master in Chambers had set it aside, and had given the Company leave to defend the action. He therefore had to consent to the dismissal of the petition. His Lordship dismissed the petition, with costs.

Gas Explosion in Manchester.—Last Friday morning, shortly after eleven o'clock, an explosion occurred in the testing-room at the works of Messrs. R. & J. Dempster, at Newton Heath, Manchester, by which two workmen, named Robert Hart and Albert Clayton, were injured. It seems that the men with another workman were in the testing-room, and Clayton by mistake turned a handle which filled with gas a portion of the apparatus, which exploded. Hart and Clayton were badly bruised by the broken ironwork. The third man, however, escaped with nothing worse than a few scratches. As soon as possible the men were conveyed to the Ancoats Hospital, where it was found that Clayton had received injuries to his back, and was also suffering from shock. It was deemed advisable to detain him.

Proposed Improvements at the Abercarn Gas-Works.—A special meeting of the Abercarn District Council was held last Tuesday evening—Mr. J. Richards, J.P., presiding—to receive and consider the report of Mr. T. Canning, of Newport, who had been called in to advise them on the question of the desirability of increasing the production and storage capacity of their gas-works. In the course of his report, he pointed out that the works were deficient in retort and exhauster power, producing only 70,000 cubic feet of gas per 24 hours, when they ought to produce 80,000 feet; thus losing more than 12 per cent. of the value of the coal, coke, and labour in working. This he attributed to three causes—viz., bad retorts, inefficient exhausting plant, and an inadequate chimney-stack for the number of furnaces. He recommended, as part of the complete scheme, a plan which showed a setting of three arches, of seven retorts each, of shallow regenerator furnaces, which could be economically put up, but would involve the existence of the present retort-house, &c. After referring in fuller detail to his recommendations, Mr. Canning said the total cost of the scheme would be about £3500—£2500 in the present year, and a further £1000 in 1904. He also pointed out that all the proposals need not necessarily be carried out at once, but might only be gradually adopted as required. In the course of a further verbal explanation, he said the proposals, if carried out, would, he estimated, effect a saving of at least £100 per annum in the cost of coal, labour, &c. It was eventually decided to defer the further consideration of the report to a special meeting on the 10th inst.

Bradford Public Lighting.—At a meeting of the Bradford Corporation Gas Committee last Friday, the Gas Engineer (Mr. Charles Wood) submitted a return with regard to the lighting of the streets. It showed that at the end of December there were 10,898 public lamps in the city, located in the following districts: Bradford, 8199; Allerton, 219; Heaton, 246; Thornbury, 243; Ripleyville, 49; Eccleshill, 393; Idle, 302; North Bierley and Wyke, 773; Tong, 284; and Thornton, 190. There is an increase of nearly 900 lamps compared with the year 1899.

Under the title of the Brett and Henneberger Company, Limited, a company has been registered with a capital of £5000, in £1 shares, to acquire the branch of the business of the Welsbach Incandescent Gas-Light Company, Limited, known as Elm Works, Earlsfield, Surrey.

The Eastbourne Gas Company are sending out a neatly printed *brochure* bearing the somewhat striking title of "My Darkie Friend"—the friend alluded to being a gas-stove, the virtues and excellencies of which are presented to the reader in a chatty and agreeable way by the authoress (Florence Moore).

"Mond Gas" is the subject of an article contributed by Mr. H. A. Humphrey, Assoc.M.Inst.C.E., to the current number of "The World's Work;" and the new Principal of the Stevens Institute of Technology, Dr. A. C. Humphreys, deals with the question of "The Business Training of the Engineer" in "Cassier's Magazine."

The Taff Vale litigation has been put an end to by an arrangement, the principal feature of which is that the Amalgamated Society of Railway Servants pay the Railway Company £23,000 in satisfaction of all damages and costs. On Monday last week, Mr. Justice Wills gave judgment for the plaintiffs on the terms agreed.

In the six months ending December 31 last, there was an increase of 4 per cent. in the quantity of gas sold by the Alford Gas Company, of which Mr. Isaac Carr is the Chairman; and the working resulted in a balance of £348 for distribution. This allowed of the payment of a dividend at the rate of 5 per cent. per annum, with £201 to go forward.

On the occasion of a visit by the King to the Gaiety Theatre last Tuesday, the electric light suddenly went out, and the place was left in darkness. Commenting on the occurrence, the "Pall Mall Gazette" says: "The faithful understudy gas, which no theatre should be without, was fortunately ready at the wings, and the King had not to be conducted to his carriage by a policeman's bull's-eye. Gas is very dependable; and it only once broke down in the great strike of the seventies, when colza-oil lamps had to be borrowed wholesale for the Strand theatres. Many elderly people still living remember wax (or reputed wax) candles at the Haymarket—the last theatre that gave its conservant adhesion to coal gas—which dripped on to the backs of the best clothes of the old playgoers. In this case it was really a question if the play was worth the candle."

SPIRAL GUIDED GASHOLDERS

WITH WALKER'S IMPROVED METHOD OF STRONG PLATING FOR ATTACHMENT OF GUIDES.

GASHOLDERS WITH GUIDE-FRAMING.

STEEL TANKS.

FOR FULL PARTICULARS WRITE TO

C. & W. WALKER, Ltd.,

Midland Iron-Works: DONNINGTON, NEWPORT, SALOP.

London Office: 110, CANNON STREET, E.C.

The Directors of the East London Water-Works Company have decided to recommend the payment of a dividend at the rate of 8 per cent. per annum for the half year ending at Christmas last.

The Lancaster Corporation have placed with Messrs. Clapham Bros. Limited, of Keighley, an order for four purifiers on Green's principle, complete with staging, centre-valve and connections, and lifting apparatus.

At the second ordinary meeting of the South Staffordshire Mond Gas Company last Friday, Sir Benjamin Hingley, in moving the adoption of the report, said that, after examining sites for the central station at Wolverhampton, Walton, Dudley, and other places, the Board finally settled down at Dudley Port, adjoining the London and North-Western Railway, which would give them railway and canal accommodation. They found that the cost would be considerably more than they expected, and therefore there had been a modification of the plans, with the result of saving from £20,000 to £25,000 in the cost of erection. Mr. Alfred Mond seconded the motion, saying they might anticipate that the works would be complete in the course of twelve months.

The Directors of the Leeds Fire-Clay Company have declared the usual interim dividend on the ordinary shares for the six months ending Dec. 31 last at the rate of 5 per cent. per annum.

The Directors of Messrs. Stewarts and Lloyds, Limited, of Glasgow and Birmingham, have decided to recommend a dividend of 11 per cent. on the ordinary capital, placing £11,000 to the reserve, writing off £15,000, and carrying forward £50,000.

Messrs. Joseph Taylor and Co., of Bolton, have secured an order from Messrs. Pease and Partners, Limited, for their Bankfoot Chemical Works, for a 1½-inch plate lead combination saturator, designed to be able to discharge its salt by fishing, self-emptying, or steam, and constructed with double detachable ammonia pipes and detachable acid pipe.

A successful gas exhibition has just been held at Leamington by Flavel Range and Imperial Gas-Stoves, Limited. Hitherto the Gas Company have not hired out cooking and heating stoves, but they have now arranged to do so; and as a result of this and of the exhibition, the firm named have sold or let on hire through the Company close on 200 "Imperial" and "Royal Windsor" cooking-stoves.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

AGENTS (Gas-Tube Trade). No. 4c01.
GENERAL FITTER. Glyncorrwg Gas and Water Department. March 9.
MECHANIC AND SMITH. No. 3983.
RETORT SETTER. Rotherham Gas Department.
WORKING FOREMAN. No. 4cc2.

To Water Companies.

DIRECTORSHIP. N. P., care of Vickers.

Situations Wanted.

GAS-FITTER. Baker, Colchester.
TRAVELLER GAS-STOVE TRADE. W. W., Faversham

Plant, &c. (Second-Hand) for Sale.

ACETYLENE PLANT. Kitson Lighting Company.
CONDENSER. Redditch Gas-Works.
EXHAUSTER AND ENGINE (combined). No. 3987.

Sales of Stocks and Shares.

CITY OF ELY GAS COMPANY. March 18.
CROYDON GAS COMPANY. March 8.
DORKING GAS COMPANY. March 24.
HASTINGS GAS COMPANY. March 18.
LEA BRIDGE GAS COMPANY. March 18.
LEATHERHEAD GAS COMPANY. March 6.
LOWESTOFT WATER AND GAS COMPANY. March 18.

Sales of Stocks and Shares (*Continued*)—

SWANAGE GAS AND WATER COMPANY. March 24.
ROMFORD GAS COMPANY. March 24.
WORTHING GAS COMPANY. March 24.

TENDERS FOR

Ammoniacal Liquor.

HINDLEY GAS DEPARTMENT. Tenders by March 16.
MACCLESFIELD GAS DEPARTMENT. Tenders by March 16.

Coal and Cannel.

STOCKPORT GAS DEPARTMENT. Tenders by March 9.

Coke.

HUDDERSFIELD GAS DEPARTMENT. Tenders by March 10.

Engine and Exhauster.

DEVONPORT GAS DEPARTMENT. Tenders by March 23.

Fire Clay-Goods.

STOCKPORT GAS DEPARTMENT. Tenders by March 9.

Gasholder Tank.

PEMBROKE DOCKS GAS COMPANY. Tenders by March 6.

Gasholders.

COPENHAGEN. Tenders by April 7.

General Stores, Ironmongery, &c.

STOCKPORT GAS DEPARTMENT. Tenders by March 9.

Meters and Meter Fittings, &c.

STOCKPORT GAS DEPARTMENT. Tenders by March 9.

Pipe Laying.

DERBY WATER DEPARTMENT. Tenders by March 16.

Purifier Grids.

STOCKPORT GAS DEPARTMENT. Tenders by March 9.

Retorts.

STOCKPORT GAS DEPARTMENT. Tenders by March 9.

Tar.

BURNLEY GAS DEPARTMENT. Tenders by April 8.
EXETER GAS COMPANY. Tenders by March 14.
HINDLEY GAS DEPARTMENT. Tenders by March 16.
MACCLESFIELD GAS DEPARTMENT. Tenders by March 16.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.		Cubic Feet Daily.
BLACKBURN	1,250,000	YORK	750,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	ROCHESTER	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	KINGSTON, ONT.	300,000
COLCHESTER	300,000	CRYSTAL PALACE DISTRICT	2,000,000
BIRKENHEAD.	2,250,000	DULUTH, MINN.	300,000
SWINDON (New Swindon Gas Co.)	120,000	CATERHAM	150,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	LEICESTER	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	ENSCHEDE (HOLLAND)	150,000
HALIFAX	1,000,000	BUENOS AYRES (RIVER PLATE CO.)	700,000
TORONTO	250,000	BURNLEY	1,500,000
OTTAWA.	250,000	KINGSTON-ON-THAMES	1,750,000
LINDSAY (Remodelled)	125,000	ACCRINGTON	500,000
MONTREAL	500,000	TONBRIDGE	300,000
TORONTO (Second Contract Remodelled)	2,000,000	STRETFORD	500,000
BELLEVILLE	250,000	OLDBURY	300,000
OTTAWA (Second Contract)	250,000	TODMORDEN	500,000
BRANTFORD (Remodelled)	200,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
ST. CATHERINES (Remodelled)	250,000	YORK (Second Contract)	750,000
KINGSTON, PA.	125,000	ROCHESTER (Second Contract)	500,000
PETERBOROUGH, ONT.	250,000	NEWPORT (MON.)	250,000
WILKESBARRE, PA.	750,000	TOKIO, JAPAN.	1,000,000
ST. CATHERINES (Second Contract)	250,000	PERNAMBUCO (Brazil)	125,000
BUFFALO, N.Y.	2,000,000	MALTON	150,000
WINNIPEG, MAN.	500,000	DULUTH, MINN. (Second Contract)	300,000
COLCHESTER (Second Contract)	300,000	BROCKVILLE (ONT.)	250,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,200,000 Cub. Ft. SMETHWICK, 500,000 Cub. Ft. LEICESTER (2nd Cont.), 1,000,000 Cub. Ft.
GRAVESEND, 300,000 C. Ft. NEWPORT, MON. (2nd Cont.), 250,000 C. Ft. TORONTO (3rd Cont.), 750,000 C. Ft.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance. If credit is taken, the charge is 25s. a year.

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Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

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160, 161, & 162, PALMERSTON HOUSE,
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ANDREW STEPHENSON, AGENT. All communications RE OXIDE to the COMPANY as above.

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"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

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Offices: Commercial Buildings, LEEDS. Correspondence invited.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

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BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.

For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

NEW GAS PLANT CEMENT.

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VICTORIA PAINT WORKS,
MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

GAS TAR wanted.

BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PATENTS AND TRADE MARKS

PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.

MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 248 Holborn.

IT is worth your while to buy direct.

THE RELIANCE LUBRICATING OIL COMPANY 19 and 20, Water Lane, Great Tower Street, London, E.C., handle all kinds of Lubricating Oils, for Engines, Cylinders, Dynamos, Spindles, &c., Burning Oils, Solar Distillates, Carburetting Oils, and Spirits for Gas Making; Motor Oils, Fuel Oils, Animal, Fish, and Vegetable Oils, &c., for all purposes. Write for our "Trade Mark" Inkstand, sent free to customers. Non-customers, 2s. 6d. each. RELIANCE LUBRICATING OIL COMPANY, London, Glasgow, Newcastle-on-Tyne, &c. Established 1858. Telegraphic Address: "Subastral," London; A.B.C. Code used. Telephone No.: Avenue 5891.

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H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

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Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

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First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

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MOTOR CARS for Pleasure or Business.

MOTOR VANS for Coin Collecting.
MOTOR TIP LORRIES, and TAR OR OIL WAGGONS.

LAURENCE BELL, Gas and Motor Engineer, INNERLEITHEN and PEEBLES.

CARBONIZING FOREMAN.

THE Vacancy advertised under No. 3996 has now been filled, and the Advertiser desires to THANK all who applied for the position.

SITUATION Wanted as Gas-Fitter (either Gas Company or Contractors), Inside or Outside Fitting. Used to Compo. and Iron Pipe Work; also Tin Work if required, Stove Repairing, &c. Age 31.

Address BAKER, 72, Castle Road, COLCHESTER.

WATER COMPANIES.

AN Engineer, with several years' experience in managing a very successful Waterworks undertaking, is prepared to QUALIFY FOR A POSITION ON THE BOARD of Company where Expert Knowledge would be useful.

Address N.P., care of J. W. Vickers, 5, NICHOLAS LANE, E.C.

TRAVELLER, with good connection in South Eastern Counties, lately representing good Firm, desires re-engagement. Excellent References. Age 27.

Address W. W., 83, Preston Street, FAVERSHAM.

MECHANIC and Smith wanted, at once. Permanent Situation to good man (Birmingham District).

Apply, by letter, stating all Particulars, to No. 3983, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS TUBE TRADE.

WANTED, Agents for all parts of England to call upon Gas-Works. Could be worked with other Agencies. Applicants must have good connection.

Address No. 4001, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Working Foreman, who must have a practical knowledge of the whole routine of a Gas-Works. Must be able to undertake all Repairs and lay Mains and Services, and willing to assist generally. Age 30 to 40. Wages 27s., with House, Gas, and Fuel.

Apply, by letter, stating present Position, Age, &c., with not more than Two Testimonials of recent date, to No. 4002, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GLYNCORRWG URBAN DISTRICT COUNCIL.

THE above Council invite Applications from competent persons for the appointment of GENERAL FITTER for their Gas and Water Works.

The duties will include the laying and jointing of Mains, Gas and Water Services, Fixing Gas-Meters, and General Fitting and Plumbing Work. Salary 32s. per week.

Applications, stating Age and previous Experience, together with *copies* of Three recent Testimonials, to be sent to us by the 9th of March next.

CUTHBERTSON AND POWELL,
Clerks to the Council.

58, Water Street, Neath,
Feb. 16, 1903.

COAL GAS TAR wanted.

Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding-Scale Basis.

State Quantity to offer for Prompt and Forward Delivery.

The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.

FIRE CEMENT, PAINT, GAS COAL.

BALE & CHURCH, 5, CROOKED LANE, LONDON, E.C.

COUNTY BOROUGH OF ROTHERHAM.

(GAS DEPARTMENT.)

WANTED, an experienced Retort SETTER. Must thoroughly understand Inclined Retorts and Regenerative Furnaces. Permanent appointment to a suitable Man.

Apply, stating Wages required, to the undersigned on or before March 16, 1903.

FRANK A. WINSTANLEY,
Engineer and Manager.

GAS-METERS wanted, old disused Wet.

Copper Lamp Frames, Brass, Pewter, Tin, Zinc, Lead Ashes, Old Copper Electric Cable, &c., for Cash.

J. SMITH, Canal Road, BRADFORD.

TO BE SOLD—Purifiers, Two or Four, 10 feet square by 4 ft. 6 in. deep, planed Joints, Connections, and Overhead Girders.

Write J. WRIGHT, 181, QUEEN VICTORIA STREET, E.C.

A BARGAIN—Water-Cooled Condenser in perfect condition. Capacity 25,000 cubic feet per 24 Hours.

Address A. E. LAYTON, Gas-Works, REDDITCH.

EXHAUSTER, with Engine combined, 8000 to 15,000 cubic feet per hour, all Connections, by Tangye. In capital order. £90.

Address No. 3987, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A 200-Light Acetylene Gas Generating Apparatus, by Stott and Co., of Oldham. Complete and almost new. Offers invited.

Apply to the KITSON LIGHTING COMPANY OF GREAT BRITAIN, LIMITED, COVENTRY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

FOR SALE—Very good Gas Plant as under:—

PURIFIERS—Four 12 feet square, with 8-inch Centre-Valve and Connections. Planed Joints.
Kirkham WASHER-SCRUBBER, 300,000 cubic feet per diem., with Engine and 8-inch Valves and Connections.
Livesey WASHER, 250,000 cubic feet per diem, with 8-inch Valves and Connections.

Photos. sent on application to SAML. WHILE AND SON 60, Queen Victoria Street, LONDON, E.C.

GASHOLDER.

THE Lighting Department of the Corporation of Copenhagen invite TENDERS for the supply and erection of a THREE-LIFT GASHOLDER of 3 Million cubic feet capacity.

Full Particulars and Drawings may be obtained on application to the Engineering Office of the Eastern Gas-Works (Ostre Gasvaerks Tegnestue), Copenhagen.

Tenders, accompanied by the said Drawings, &c., to be delivered to the Director of the Lighting Department, 22, Vestre Boulevard, Copenhagen, not later than April 7, 1903, noon.

The Department will not be bound to accept the lowest or any Tender.

THE LIGHTING DEPARTMENT OF COPENHAGEN.
Feb. 10, 1903.

THE Urban District Council of Hindley are prepared to receive TENDERS for the purchase of the TAR and AMMONIACAL LIQUOR produced at their Gas-Works during the ensuing Twelve Months.

Full Particulars, with Form of Tender, can be obtained on application to Mr. Wm. Dickinson, Gas and Water Manager.

Sealed Tenders, endorsed "Tender for Tar and Ammoniacal Liquor," to be lodged with the undersigned not later than Monday, March 16, 1903.

By order,
THOMAS ROBEY,
Clerk to the Council.

Offices: Cross Street,
Hindley, Feb. 27, 1903.

COUNTY BOROUGH OF BURNLEY.
(GAS DEPARTMENT.)

TO TAR DISTILLERS.

THE Gas Committee of the Corporation of Burnley are prepared to receive TENDERS for the purchase, on the Sliding-Scale Basis, of the GAS TAR to be produced at their Works during a period of One, Two, or Three Years commencing the 1st of April, 1903.

Full Particulars and Form of Tender may be obtained on application, in writing, to the undersigned.

Tenders, under seal, endorsed "Tender for Tar," and addressed to the Chairman of the Gas Committee, Town Hall, Burnley, must be sent in on or before Wednesday, the 8th of April, 1903.

JNO. P. LEATHER,
Gas Engineer.

Gas-Works, Burnley,
Feb. 28, 1903.

COUNTY BOROUGH OF HUDDERSFIELD.
(GAS DEPARTMENT.)

SURPLUS COKE.

THE Corporation of Huddersfield invite TENDERS for the surplus COKE at the Gas-Works for the Year commencing on the 1st of April, 1903.

Particulars of approximate quantities and conditions may be obtained on application to the Gas Engineer and Manager, Huddersfield.

Sealed Tenders, endorsed "Tender for Gas Coke," must be delivered, free of charge, addressed in the handwriting of the Tenderer or his Agent, to the Town Clerk, Town Hall, Huddersfield, not later than Twelve o'clock at noon on Tuesday, the 10th day of March, 1903.

The Corporation do not bind themselves to accept the highest or any Tender.

By order,
F. C. LLOYD, Town Clerk.

Town Hall, Huddersfield,
Feb. 25, 1903.

DERBY CORPORATION WATER-WORKS.

TO PIPE LAYING CONTRACTORS.
CONTRACT No. 10.

THE Corporation of Derby are prepared to receive TENDERS for the laying of about 4½ miles of Cast-Iron SOCKET PIPES, 30 inches and 15 inches diameter.

The Drawings may be inspected, and Specifications, Schedules of Quantities, and Forms of Tender may be had, on payment of the sum of Two Guineas (to be returned on receipt of a *bonâ-fide* Tender) on application at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., or at the Office of Mr. John Ward, Borough Surveyor, Derby, on and after Tuesday, the 3rd of March, and Tenders must be delivered at my Office at or before Ten o'clock in the morning of Monday, the 16th of March.

The Corporation do not pledge themselves to accept the lowest or other Tenders.

G. TREVELYAN LEE,
Town Clerk.

Derby, Feb. 26, 1903.

COUNTY BOROUGH OF STOCKPORT.
(GAS AND ELECTRICITY DEPARTMENT.)

TENDERS FOR STORES, CANNEL, COAL, AND ENGINE SLACK.

THE Gas and Electricity Committee are prepared to receive TENDERS for the supply of the following MATERIAL from April 1, 1903:—

General Stores for One Year.
Cannel and Coal for One, Two, or Three Years.
Engine Slack for Three Months.

1. Bolts and Nuts.
2. Brushes.
3. Brass and Meter Fittings.
4. Cartage for 2¾ Years, from June 30, 1903.
5. Castings.
6. Drysaltery.
7. Retorts & Fire Goods.
8. Glass, Red and White Lead.
9. Iron and Steel.
10. Ironmongery.
11. Lead Pipe, Tin.
12. Mill Furnishing.
13. Oils and Tallows.
14. Purifier Grids.
15. Ropes and Flax.
16. Shovels, Pick Heads.
17. Timber, English and Foreign.
18. Tubing.
19. Wet and Dry Meters.
20. Stationery.
21. Lime.
22. Cannel and Coal for One, Two, or Three Years.
23. Engine Coal for Three Months.

Forms of Tender and all further Information may be obtained on application to the Engineer, Gas-Works, Portwood.

No Form of Tender other than that issued by the Committee will be accepted.

Tenders endorsed "1, 2, 3, &c.," as the case may be, addressed to the Chairman of the Gas and Electricity Committee, Portwood, Stockport, to be sent in on or before March 9, 1903.

No Tender will be accepted without satisfactory proof that the firm tendering pays the Trade Union rate of wages and observes the Trade Union number of hours as are usually paid and observed in the district where the goods are made or produced.

By order,
ROBERT HYDE, Town Clerk.

Stockport, Feb. 23, 1903.

TO CONTRACTORS AND BUILDERS.

THE Pembroke Docks and Town Gas Company invite TENDERS for the Excavation and Construction of a MASONRY GASHOLDER TANK, 92 feet in diameter, by 25 feet deep, at their Works, Pembroke Dock.

Plans and Specifications may be seen at the Offices, Gas-Works, Pembroke Dock.

Sealed Tenders, addressed to the Chairman of the Company, G. Wheatley Cobb, Esq., to be delivered at the Works on or before March 6, 1903.

The lowest or any Tender not necessarily accepted.

A. HORACE BROOKMAN,
Manager.

Pembroke Dock,
Feb. 21, 1903.

BOROUGH OF MACCLESFIELD.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Gas Committee are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Works during the Twelve Months commencing the 1st day of April next.

Tenders for the Tar or Liquor separately to be sent in not later than Monday, the 16th of March, 1903, addressed to the Chairman of the Gas Committee, Town Hall, Macclesfield, and endorsed "Tender for Tar, &c."

For Conditions, apply to Mr. E. L. Newbigging, Engineer, Gas-Works, Macclesfield.

The Committee reserve to themselves the right of accepting any Tender for the Tar or the Liquor separately.

The highest or any Tender not necessarily accepted.

ARTHUR T. PATTINSON,
Town Clerk.

Feb. 21, 1903.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, Tokenhouse Yard, E.C., on Wednesday, March 18, a Two o'clock, in Lots, the following STOCKS and SHARES—

LEA BRIDGE DISTRICT GAS COMPANY,
£1000 CONSOLIDATED ORDINARY STOCK.

HASTINGS AND ST. LEONARDS GAS COMPANY,
£800 CONVERTED STOCK.

LOWESTOFT WATER AND GAS COMPANY.
70 £10 ADDITIONAL ORDINARY SHARES.

CROYDON COMMERCIAL GAS AND COKE COMPANY,
£500 "C" STOCK.

WORTHING GASLIGHT AND COKE COMPANY,
100 £10 ORDINARY SHARES.

CITY OF ELY GAS COMPANY,
£1070 ORIGINAL STOCK.

Particulars may be obtained of the AUCTIONER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
DORKING GAS COMPANY.

NEW ISSUE OF 120 £25 "D" SHARES.

MR. ALFRED RICHARDS will sell the ABOVE BY AUCTION at the Mart, E.C., on Tuesday, March 24, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ROMFORD GAS AND COKE COMPANY, LIMITED.

NEW ISSUE OF 640 £5 "B" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, March 24, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SWANAGE GAS AND WATER COMPANY.

NEW ISSUE OF £5000 4½ PER CENT. PREFERENCE "WATER" STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, March 24, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors of the
WORTHING GASLIGHT AND COKE COMPANY.

NEW ISSUE OF 300 £10 SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 24th of March, at Two o'clock precisely, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TENDERS FOR TAR.

THE Directors of the Exeter Gaslight and Coke Company invite TENDERS for their surplus TAR for Twelve Months from the 25th of March next, at per ton of 200 gallons, delivered into Contractor's Tanks at the Company's Works.

Sealed Tenders, endorsed "Tender for Tar," will be received by the undersigned on or before Saturday, the 14th of March next; but the Directors do not bind themselves to accept the highest or any Tender.

By order,
W. A. PADFIELD, Engineer and Secretary.

BOROUGH OF DEVONPORT.

THE Gas Committee invite Tenders for the supply and erection of a combined STEAM-ENGINE and 40,000 cubic feet per hour EXHAUSTER.

Copies of Specification may be obtained on application to the undersigned.

The Committee do not bind themselves to accept the lowest or any Tender.

Tenders, to be addressed to the Town Clerk, Devonport, on or before Monday, the 23rd of March, 1903, endorsed "Tender for Exhauster"

SIDNEY E. STEVENSON,
Engineer and Manager.

Gas-Works, Devonport,
Feb. 23, 1903.

LEATHERHEAD GAS AND LIGHTING COMPANY.

NOTICE is Hereby Given, of Sale by TENDER of 200 SHARES of £10 each, being a portion of the Additional Share Capital authorized to be raised in pursuance of the powers of the Leatherhead Gas Act, 1901.

No Tender will be received after Eleven a.m. on Friday, the 6th day of March, 1903.

Forms of Tender can be obtained on application to the Secretary.

By order,
JOHN YOUNG, Secretary.

Leatherhead,
Feb. 6, 1903.

THE
PETROLEUM GAS SYNDICATE

Are prepared to erect Installations from 50 to 2000 Lights of their

Petrogene Patent Carburetting Plant

for the Manufacture of Petroleum Air Gas, for Gas Companies, Urban Councils, Gas Engineers, &c., on Sale, Hire, or Royalty. Petroleum Air Gas is equivalent in cost of production to coal gas at about 1s. 6d. per 1000 cubic feet. It may be used alone or in conjunction with coal gas, and is equally suitable for Lighting, Heating, or Power purposes. No Storage necessary.

For Particulars, apply to

C. E. MASTERMAN, Assoc.M.Inst.C.E.
28, Victoria Street, Westminster, S.W.

ASBESTOS
CRESSWELL'S'

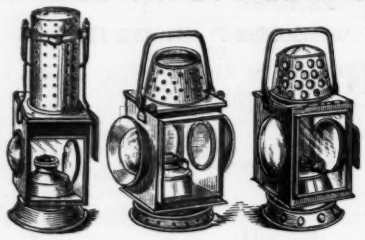
If you want Asbestos Cloths really worth the name, you must come to us. Fine, Medium, Coarse. Warranted absolutely pure. Ask for No. 2 Catalogue.
Gas-Fire Fuel.

Cresswell's Asbestos Co., Ltd.,
Wellington Mills, Bradford, Yorks.
Telephone No. 50.
Tel. Address: "Asbestos, Bradford."
Applications for Colonial and Foreign Agencies desired.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
THE GRASSMOOR CO., LD.,
CHESTERFIELD.

THE
"ROTARY"
STATION METER.
Efficiency
Demonstrated.
APPLY—
T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE,
MANCHESTER.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.

No. 1. No. 2. No. 3.
43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

JOHN HALL & CO.,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
GAS RETORTS,
And every description of Fire-Clay Goods.
RETORTS CAREFULLY PACKED FOR SHIPMENT.

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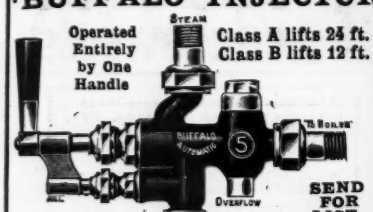

Operated Entirely by One Handle
Class A lifts 24 ft.
Class B lifts 12 ft.
SEND FOR LIST.
Telegrams: "Temperature, London." Tel. No. 9060 London Wall.
GREEN & BOULDING,
105, Bunhill Row, LONDON, E.C.

WELDON MUD
FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR
Also Removal of last Traces of
SULPHURETTED HYDROGEN
in catch position.
Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— LIMITED, —
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LONDON OFFICE
181
QUEEN VICTORIA ST.
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DRAKES
HORIZONTAL
AND
INCLINED
RETORT SETTINGS
WITH
GENERATOR
AND
REGENERATOR
FURNACES
LIMITED
CONTRACTORS
FOR
EVERY KIND
OF
GASWORKS
PLANT.
ELEVATORS
AND
CONVEYORS
HALIFAX
AND
LEEDS

GREAT SAVING
IN FUEL

"A VERY SIMPLE & INGENIOUS APPARATUS."—
VIDE "THE ENGINEER" NOV. 12TH 1897
SOLE LICENSEES:
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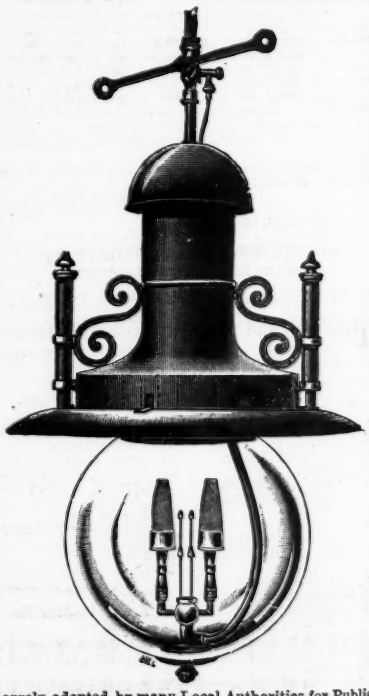
57 GRACECHURCH ST LONDON E.C.

The "Evertrusty" Draught Indicator, also known as Jensen's Flutometer (Regd. Trade Mark), Should be fixed to every boiler flue, coke-oven, retort, &c., to reduce your Coal Bill. Clear indication of variation of draught pressure obtained. Agents Wanted.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for
METERS, FIRE-CLAY GOODS, OXIDE OF IRON, AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

THE PATENT
"BEACON" GLOBE LAMP.

Largely adopted by many Local Authorities for Public Lighting, being absolutely Shadowless and Wind-proof.
H. GREENE & SONS, Limited,
Surrey Engineering Works,
Blackfriars Road, LONDON.
Telephone 1693 HOP.
Telegrams: "LUMINOSITY LONDON."

ENGINEERS KNOW

THAT PERFECT COMBUSTION MEANS HIGH EFFICIENCY.

THAT PERFECT COMBUSTION OF COAL GAS REQUIRES CORRECT PROPORTIONS OF GAS AND AIR.

THAT CORRECT PROPORTION CAN BE OBTAINED BY ADJUSTMENT, IF BOTH AIR AND GAS ARE SUPPLIED AT CONVENIENT PRESSURES.

THAT AMPLE SUPPLY UNDER PRESSURE OF BOTH ELEMENTS OF COMBUSTION ENABLES ANY POWER OF LIGHT TO BE ATTAINED.

ALL THESE ADVANTAGES ARE EMBODIED IN THE SCOTT-SNELL LAMP.

GAS COMPANIES

Feel the competition of Electric Lighting.

Should know that the public has been, by arc lighting, educated up to requiring better illumination in main thoroughfares than the present small unit lights.

OFFICIALS

Know that their duty is to earn dividends, not to maintain opinions.

An official may believe in small unit lights, but this won't console Shareholders when they see all the main street lighting swept away, and arc lights installed, because the public cannot otherwise get what they demand—big lights.

GAS SHAREHOLDERS

Are none the happier because all the great business emporiums install electric arc lights. Big lights mean big business. Business men know this, and they don't work for philanthropic purposes—it pays.

FINANCIERS

Smile to see the ease with which projects for large electric lighting schemes can be brought forward, and have interest secured, because of the big lights, whilst gas people are cavilling about decimals of a foot in the gas consumption of small burners.

DON'T YOU SEE

As long as you light main streets with small lights that there are so many required, the Authorities are necessarily particular to keep down the consumption per lamp.

DON'T YOU KNOW

That small lights have less efficiency, about half the light per foot of gas given by the large Scott-Snell lights. Why waste your possibilities?

HAVE YOU NOT PERCEIVED

The wisdom of the Electrical people in giving up small power Incandescent Electric Lamps for street lighting. Some advocates of even these small lights exist—in the Workhouse.

FOR EXACT INFORMATION

About our system write or call, and bring along your prejudices and objections, if you have any.

THE SCOTT-SNELL SELF-INTENSIFYING GAS-LAMP CO., LTD.,

53, Victoria Street,

London, S.W.

TROTTER, HAINES, & CORBETT, LIMITED,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
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LIMITED,
NEWBATTLE COLLIERIES,
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ROBERT MARSHALL,
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Prices and Analysis of all the Scotch Cannels on Application.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of **HORSLEY'S PATENT SYPHONS.** These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

COKE-BREAKERS
For Hand or Power. On Tooth-cutter or Jaw Principles.
Goodwin Barsby & Co., Engineers and Ironfounders, Leicester.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
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THE THAMES BANK IRON CO.
UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
CAST-IRON RETORTS
AND ALL KINDS OF GAS-WORKS APPARATUS.
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of **LYON'S "PATENT" GAS-MAIN SYPHONS.**
AGENTS FOR
ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

THE MANTLE.

THE **"PREMIER BONBAC"**
MANTLE
(UNDER LICENCE)
Is without doubt the finest that has ever been produced.
30s. per Gross Net.
SPECIAL TERMS TO GAS COMPANIES.
All Gas Companies should have our List of REDUCED Prices for Burners, Jena Glass, and Accessories.
WHOLESALE FITTINGS COMPANY,
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CASES FOR BINDING VOLUMES OF THE "JOURNAL"
MAY BE HAD OF THE PUBLISHER
PRICE 2s. EACH.

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INCORPORATED IN
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Machine-Made Retorts

Have been made in large quantities for the last twenty years; and during the whole of that time have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.
Retorts carefully Packed for Export.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

THE HOUSEHOLD GAS HEATER & COOKER (PARENT) COMPANY, LTD.
(ROSS SYSTEM).
Perfect Combustion.
No Smell. Great Heat.
Gas Stoves,
HEATING & COOKING.
Invaluable for Sick Room. No Flues.
LIBERAL DISCOUNTS to the Trade.
Telephone No. 5260 CENTRAL.

Recommended by the Medical Profession.
THE KING OF HEATERS.
THE CONSUMPTION OF GAS UNDER ONE FARTHING AN HOUR.
For Particulars apply to the Secretary.
Telegrams—"GASFLAMME, LONDON."
Offices and Warehouse: 47, HOLBORN VIADUCT, LONDON, E.C.

Air is Cheaper than Gas

and the **LUCAS** lamp consumes 10 parts of air for every 1 of gas.

No other Lamp

does that, and we leave it to you to draw the right inference from the fact.

"The Light is Perfection."

This is not our own opinion, but the unsolicited testimonial of numerous users.

Perfection and Cheapness

is all we can offer you, and if you do not want an ideal gas light at the lowest possible cost, we cannot hope to satisfy you.

Have you tried it?

If not, give us an opportunity of showing you a lamp which will do you credit and satisfy your clients.

Moffat's Ltd. are prepared to contract for the lighting by means of the LUCAS LAMP of entire Towns and Districts.

Moffat's Ld. are now manufacturing Lamps, both for outside and inside lighting, to consume 5 feet (200 c.p.), 10 feet (450 c.p.), and 17½ feet (700 c.p.)

All Outside Lamps are guaranteed wind-proof.

The LUCAS Lamp is cheaper than any other

Post your Inquiries or Instructions at your early convenience to:—

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HARRIS & PEARSON,
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MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

Over 400 recently Supplied to the Corporation Gas Department, Saltley, Birmingham.

Telegraphic Address: "Motive, Birmingham."

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Inclined and Ordinary Retorts,

GRICE'S
SPECIAL FASTENINGS.

WILLIAM GRICE & SONS, Ltd.,
Engineers & Gas-Engine Makers,
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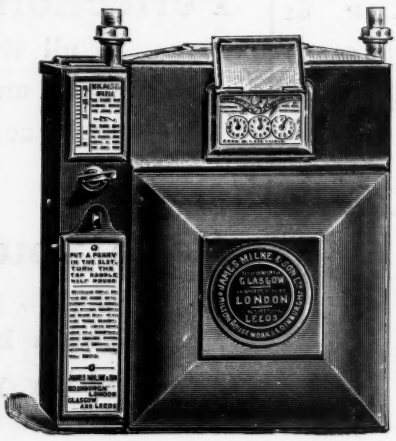
London Office: 25, Victoria St., Westminster. Mr. A. B. Coote, Representative.

Milne's New Patent Prepayment Meter.

DOUBLE VALVE ensuring certainty in closing off without strain on any part of Meter.

Most compact Attachment in the Market.

The whole of the Prepayment Mechanism is fixed outside the Ordinary Meter; the connection being made with a Shaft revolving in a Stuffing-Box.



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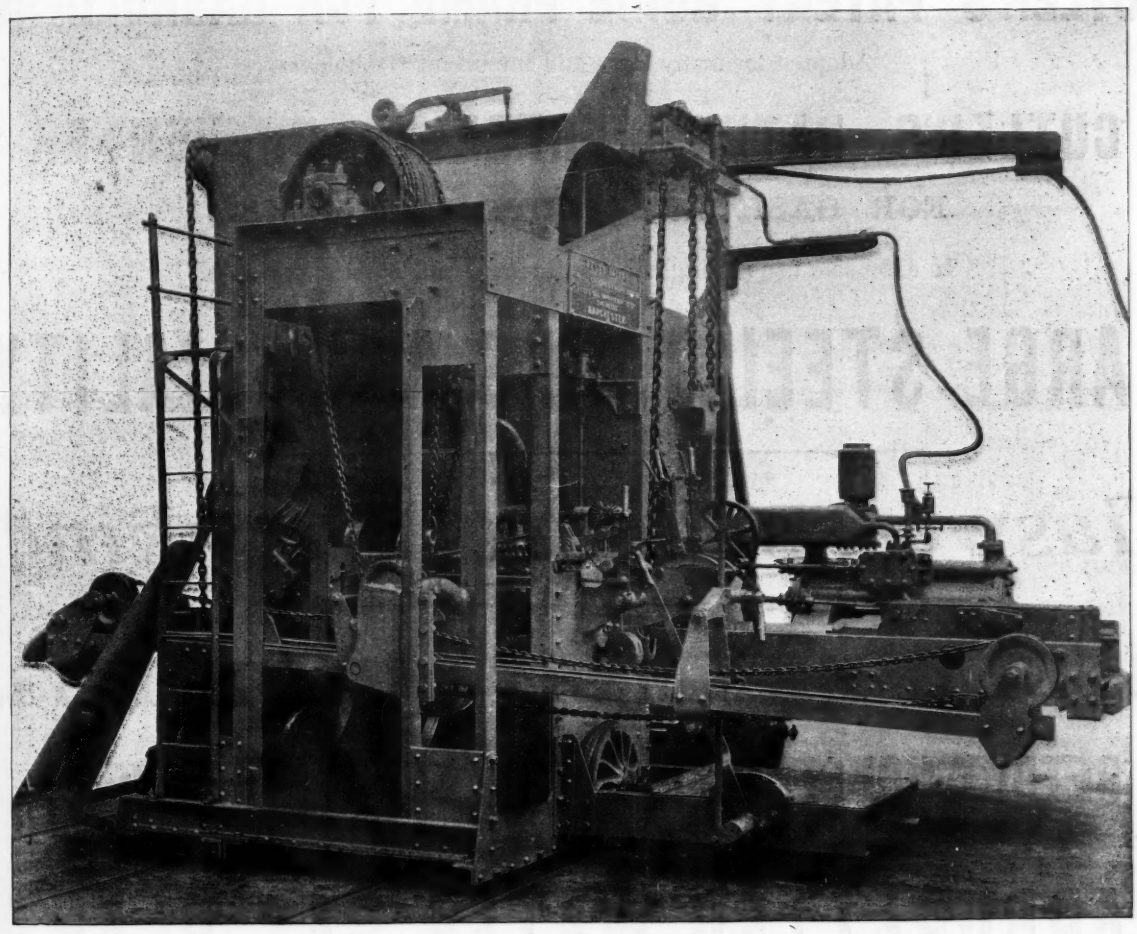
MILTON HOUSE WORKS **EDINBURGH.**
60 HOLBORN VIADUCT **LONDON.** | 111 ST. VINCENT STREET **GLASGOW.** | 48 WELLINGTON STREET and MIDLAND METER WORKS **LEEDS.**

MOBBERLEY & PERRY
STOURBRIDGE.
Manufacture & supply best quality of
Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)
Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.
FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c., &c.
EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.
Contractors for the erection of Retort-Benches complete.

WEST'S STOKING MACHINERY

COMPRESSED AIR DRIVEN
CHARGING AND DRAWING MACHINES;
COMBINED CHARGING AND DRAWING MACHINES; also
MANUAL CHARGING AND DRAWING MACHINES.



West's compressed Air Driven Charging and Drawing Machine, requiring only One Machine driver and one attendant to charge and draw the Retorts, attend to the Mouthpieces, and fill the Furnaces.

All classes of Coal can be efficiently dealt with by the West's Charging Machines, and the Retorts are charged evenly throughout with the full weight of Coal.

Retort Houses fitted with West's Regenerator Furnaces, Stoking Machinery, and Coke Conveyors reduce the cost of Carbonizing Coal to a minimum.

WEST'S GAS IMPROVEMENT CO., LTD.,

Albion Iron-Works, MILES PLATTING, MANCHESTER,

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Manufacturers for America: RITER-CONLEY MANUFACTURING COMPANY, PITTSBURGH.

SAML. CUTLER & SONS, MILLWALL, LONDON.

GASHOLDERS OF EVERY DESCRIPTION.

CUTLER'S PATENT GUIDE FRAME FOR GASHOLDERS

Adopted for many large and important Gasholders.

CUTLER'S PATENT FREEZING PREVENTER

FOR GASHOLDER CUPS AND TANKS.

In extensive use in English, Continental, and American Works.

LARGE STEEL TANKS A SPECIALITY

Gasworks Plant of every kind.

STEEL FRAMED BUILDINGS.

RETORT-HOUSE ROOFS. BENCH IRONWORK.

CARBURETTED WATER GAS PLANT.

CUTLER'S PATENT INTERLOCKING GEARS.
CUTLER'S PATENT OIL SPRAYERS.
CUTLER'S PATENT TAR SEPARATOR.
CUTLER'S PATENT DUST INTERCEPTOR.

PATENT WATER TUBE CONDENSERS

OIL-TANKS. CHEMICAL PLANT.

Makers of all kinds of Constructional Ironwork.

BIGGS, WALL, & CO.'S
Patent 'Rapid' Manual & Power Charging Machines

Installations Completed—

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Wrexham.
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Harlow.
Great Southern and Western Railway.
Dunedin, New Zealand.
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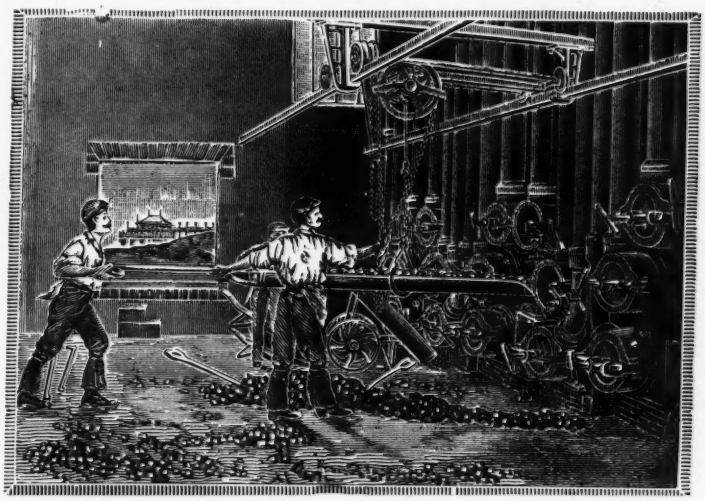

No Gas Company should be without a "Rapid" Machine.

Post Address: 13, CROSS STREET, FINSBURY, LONDON, E.C.

Telegrams: "RAGOUT, LONDON." Telephone 273 CENTRAL.

Repeat Orders—

Yeovil.
Newport.
Southbank.
Worthing.
Aldershot.

In course of Construction—

Bendigo, Australia.
River Plate Gas Co.
Brentwood.

POWER MACHINES
AT
Epsom,
Shettleston Oil and Chemical Co.
Truro.

R. LAIDLAW & SON, LIMITED.
GAS & WATER ENGINEERS.
MANUFACTURERS OF WET & DRY GAS-METERS,
SIEMENS WATER-METERS,
PREPAYMENT GAS-METERS.

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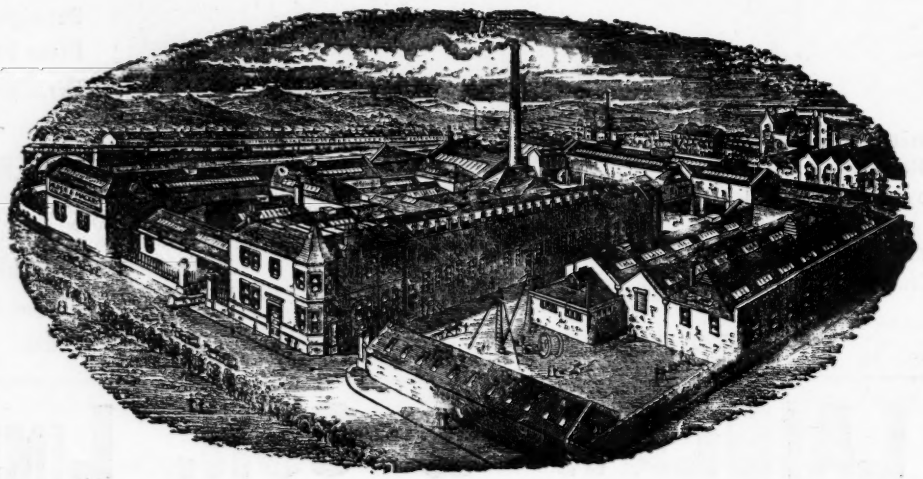

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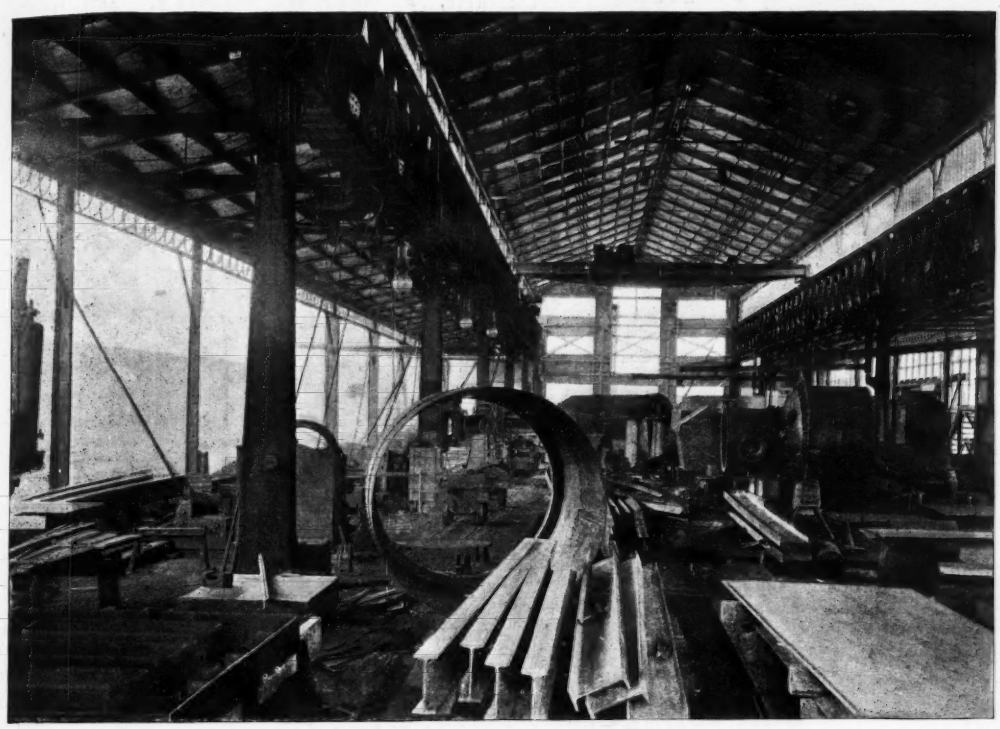

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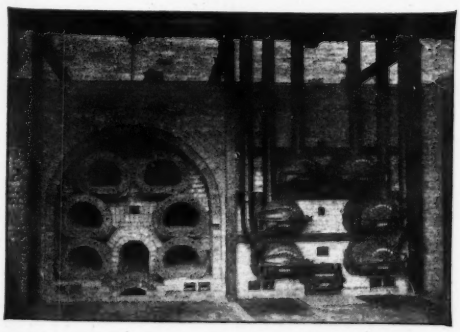

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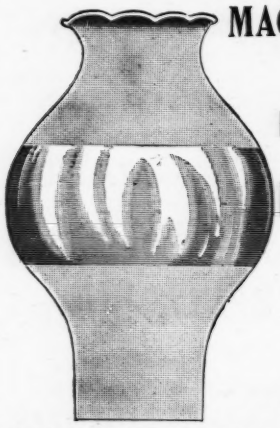

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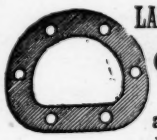

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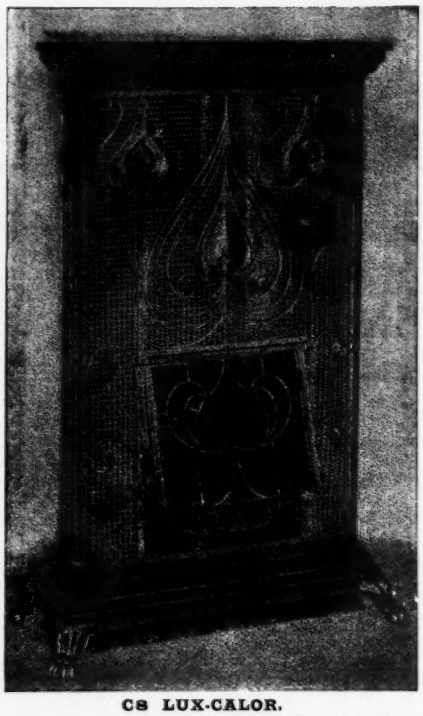

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[See also Advt. p. 528.

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